The Impacts of Urban Expansion on Road Infrastructure Development: The case of Adama City, Lugo Sub-city, Oromia Region

Kedir Jemal

A Thesis Submitted to the department of Architecture,

College of Civil Engineering and Architecture

Presented in Partial Fulfillment of the Requirement for the Degree of Master's in Urban Planning and Design

Office of Graduate Studies Adama Science and Technology University

May, 2025

Adama, Ethiopia

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Name of Advisor: **Belay Zeleke(PhD)**

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Declaration

I hereby declare that this Master's Thesis titled "The Impacts of Urban Expansion on Road Infrastructure Development: The Case of Adama City, Lugo Sub-city, Oromia Region" is my original work. It has not been submitted to any other university for the award of any academic degree, diploma, or certificate. All sources and materials used in this thesis have been properly acknowledged through appropriate citations.

Kedir Jemal	_____	_____
Name of the student	Signature	Date

Recommendation

I, the advisor of this thesis, hereby certify that I have reviewed the revised version of the thesis entitled **"The Impacts of Urban Expansion on Road Infrastructure Development: The Case of Adama City, Lugo Sub-city, Oromia Region,"** prepared under my guidance by Kedir Jemal, submitted in partial fulfillment of the requirements for the degree of **Master of Science in Urban Planning and Design.** Therefore, I recommend the submission of revised version of the thesis to the department following the applicable procedures.

Belay Zeleke(PhD) _____ _____

Major Advisor Signature Date

Approval

Approval Page of M.Sc. Thesis I/we, the advisors of the thesis entitled "The Impacts of Urban Expansion on Road Infrastructure Development: the case of Adama City, Lugo Sub-city, Oromia Region" and developed by Kedir Jemal, hereby certify that the recommendation and suggestions made by the board of examiners are appropriately incorporated into the final version of the thesis.

_____ _____ _____

Major Advisor Signature Date

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Co-advisor Signature Date

We, the undersigned, members of the Board of Examiners of the thesis by **Kedir Jemal** have read and evaluated the thesis entitled "The Impacts of Urban Expansion on Road Infrastructure Development: the case of Adama City, Lugo Sub-city, Oromia Region" and examined the candidate during open defense. This is, therefore, to certify that the thesis is accepted for partial fulfillment of the requirement of the degree of Master of Science in Urban Planning and Design.

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External Examiner Signature Date

Final approval and acceptance of the thesis is contingent upon submission of its final copy to the Office of Postgraduate Studies (OPGS) through the Department Graduate Council (DGC) and School Graduate Committee (SGC).

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Department Head Signature Date

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College Dean Signature Date

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Office of Postgraduate Studies, Dean Signature Date

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List of Acronyms and Abbreviations

- CBOs - Community Based Organizations
- CSA - Central Statistics Agency
- ERA - Ethiopian Road Authority
- GDP - Gross Domestic Product
- G.C - Gregorian Calendar
- GIS – Geographic Information System
- ICT - Information Communication Technology
- NGOs - Non-Governmental Organizations
- OECD - Organization for Economic Co-operation and Development
- ROW - Right of Way
- RSDP - Road Sector Development Program
- SPSS - Statistical Package for the Social Sciences
- UN - United Nations
- USGS - United States Geological Survey

Abstract

Many cities worldwide are growing very rapidly, leaving urban growth and road infrastructure planning with continuous challenges. Adama City Lugo Sub-City expanding rapidly, without considering the need of additional road infrastructure development. The study used explanatory and descriptive research methods. It also used primary data, which were obtained through systematic cluster sampling of 168 households, and purposively selected of 14 respondents totally 182 for sample survey and 14 professions purposively selected for interview and secondary data as well. In conducting the study, the required data was collected through questionnaires. The collected data were analyzed using descriptive statistics and GIS tools. The results showed, all land use changed six significant land use classes (housing, commercial, municipal services, manufacturing and ware house, road network and transportation and special function) have rapidly and actively changed. The road infrastructure provision is still insufficient and in poor condition. Most roads are insufficiently maintained and many streets and compacted earth, lack proper maintenance and absences of drainage is causing dust in dry season and mud during the rain seasons. The study showed urban expansion have contributed positively and negatively; positively it have brought an increasing in road length, the generation of sister infrastructures, changing social life and maintaining urban form and the study also showed that it have contributed negatively, on compensation cost, construction cost, socio economic and topographic impacts.

Keyword: Impact of Urban Expansion, Road Infrastructure Development and urban growth

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the Study

Road infrastructure plays a vital role in urban development. It provides mobility options for people and goods and has the potential to contribute to urban growth and the level of economic activities through the provision of good quality, accessible road networks. According to Meyer and Miller (2001), urban expansion and road infrastructure development are highly correlated issues; on one hand, road infrastructure attracts urban development. On the other hand, urban growth and population causes an increase in travel demand and thereby an increase in requirements for road infrastructures. However, it is highly affected by rapid urban growth due to population growth. According to United Nation (2004), over **48%** of the world's population estimates in urban areas and by 2030, this figure is predicted to increase to **61%**.

This problem is also highly aggravated in Adama City specifically Lugo Sub-City as it is expanding horizontally without considering the necessity of road infrastructure development. This is due to population growth in Adama City and Lugo Sub-City which is previously has accounted for **85,203** in 2017 but now it dramatically increased to **150,374** (Adama City Plan Commission, 2023). In general, rapid population growths have contributed to urban expansion that created big challenges to the urban manager in the provisions of road infrastructure in Lugo Sub-City, in Adama City. The existing Infrastructure and Utilities cover an area of **319.28** hectares that is **20.61 %** out of the total land use. The study area has no adequate asphalted road at all, as one goes from core to periphery areas the Gravel Streets become earth surfaced, low quality and has drainage problem. The road network of the study area is somewhat seems grid-pattern informally developed areas and has combination of straight and haphazard development in informal housing areas. The pattern of the existing street system is the result of original settlement pattern, terrain, occupation period developments, and effects of the grid regional outlets of the city. Lugo has no formal car parking area; vehicles are parked wherever there is open space, especially, along the major streets in core areas of the city, in front of shops and markets (Adama Municipality yearly report, 2022).

1.2. Statement of the Problem

Many cities worldwide are growing very rapidly, leaving urban growth and road infrastructure planning with continuous challenges in planning for livable environment. This rapid growth and expansion of urban area causes tremendous interconnected urban growth and road infrastructure issues. The increasing of urbanization and numbers of population requires additional roads and maintenance of the existing roads to accommodate the flow of transportation. Rapid economic growth and urbanization demands well integrated roads to address and achieve economic objectives. It is well known that the public sector alone cannot bear the burden of supplying; managing; and maintaining roads to meet a growing transportation demand in urban areas (Ayichew, 2013).

The rapid expansion of urban area is directly affected by fast growing of population that results spatial expansion, land use change and increase mobility, which finally causes the demands towards road infrastructure development. To this effect, several researchers have been participated on urban change phenomenon (like, Brueckner, 2003; Allen and Lu, 2005; Herold et al; (2002); Hennriquez et al.; (2004); Aguayo et al; (2006). Throughout their discussion of the effects of urban expansion on road network development have not yet addressed.

Some of these problems are the inconsistency and lack of clarity of national projects, access to designations becoming bewildered, project complexity and unbending approval process, weakness of the integrated decision-making capability and Efficiency and adequacy of the land acquisition process. Infrastructure construction, there has to be a quick decision that marks success or failure. Multi-criteria decision-making analysis came to simulate intricate problems such as these (Espinoa et all, 2014). With its historical landmarks, Kathmandu is an emerging city in which numerous plans and concepts have been embraced for growth. Like most urban centers in the emerging world, the city has been witnessing rapidly growing population growth, social as well as economic challenges as well as challenges of inadequate urban management of growth, including inadequate infrastructure as well as squatter settlements with grave environmental consequences including air, water as well as other forms of pollution(Thapa et all,2008). Similarly, in Adama City's Lugo Sub-city, the same has been the case. Therefore, the study aims to examine the impact of urban expansion on road infrastructure development in the Lugo Sub-city, Adama City.

1.3. Research Objective

1.3.1. Main Objective

The main objective of this study is to analyze the impacts of urban expansion on road infrastructure development in Lugo Sub-city, Adama City.

1.3.2. Specific Objective

1. To examine the trends of urban expansion in Lugo Sub-city,
2. To analyze the current condition of road infrastructure in the study area, and
3. To demonstrate the impacts of urban expansion on road network development.

1.4. Research Question

1. At what trends of urban expansion is happening in Lugo sub-city?
2. What are the existing conditions of road infrastructure in the study area?
3. What are the impacts of urban expansion on road network expansion?

1.5. Significance of the Study

This study is significant as it addresses the critical relationship between rapid urban expansion and road infrastructure development in Lugo Sub-City. As the sub-city, experiences accelerated growth in population and spatial coverage, understanding the implications of this expansion on existing and future road networks becomes essential for sustainable urban development. The findings of this study will provide valuable insights for urban planners, transport engineers, and policymakers by identifying the challenges and gaps in the current infrastructure planning process. It will highlight how uncoordinated urban growth can strain road systems, leading to traffic congestion, reduced accessibility, and inefficient land use. For local government authorities and stakeholders, the study serves as a practical guide to aligning urban development policies with infrastructure capacity. It emphasizes the need for proactive planning, integrated transportation systems, and investment in resilient infrastructure that supports both current and future urban needs. Moreover, the study contributes to the academic discourse on urbanization and infrastructure development in emerging urban centers, offering context-specific recommendations that may be applicable to other sub-cities facing similar challenges.

Ultimately, by promoting a more balanced and strategic approach to urban growth and infrastructure development, this research aims to support the creation of a more livable, connected, and economically vibrant Lugo Sub-City.

1.6. Scope of the Study

The study was limited to spatial, thematic and temporal scopes.

Spatial scope of the study: spatially, the study covers one Sub-city, which is Lugo, from the administrative boundary of Adama City.

Figure 1: Lugo Sub-city Boundary

Source:GIS and Google Satelite image, 2025

Thematic scope of the study: thematically, the study focuses on the impacts of urban expansion on road infrastructure development in Adama City, Lugo Sub-city.

Temporal scope of the study: temporally, the study consider the impacts of urban expansion on road infrastructural development in Adama City, Lugo sub-city. The study will be complete within the two semesters of 2024/2025 academic year.

1.7. Operational Definitions of Terms

Land use Planning: it is the logical and prudent exercise of allocating available land resources to different land utilizing activities, (e.g. Agricultural, residential, industrial) and for different purposes in accordance with the overall development vision/goal of a given locality. It entails the holistic process of determining the location and area of land to be utilized for

the implementation of social and economic development, policies, plans, programs and projects. It is based on regard for physical planning standards, vision of development, objectives and goal, evaluation of existing and potential physical condition of land and development opportunity and constraints.

Road: any public way whose principal function is the transport of vehicular and non-vehicular traffic.

Infrastructure: is a term used to describe the hard component comprising all urban physical structure systems that are mostly placed under the ground (e.g. Water pipes) and on the ground (e.g. Roadways) or over the ground (e.g. telephone and electric wires) to make public services available. Infrastructure by this guide includes roads and sewers, utility lines (water supply, electricity, telephone,) and facilities like public transport stations, garages…etc

Infrastructure road is a system of roads (linkages) as a network serving all areas occupied and used by human beings. Services are facilities such as surface of air terminals, parking lots, Interchanges, linkages, etc. which bear direct relation with infrastructure. Infrastructure level refers to the order of infrastructure which is provided or controlled at some level:- macro level and micro/local level.

Macro level infrastructures are infrastructures which cross territorial borders of federal, regional governments or cities. Macro institutions like the Ethiopian Telecommunications Corporation, the Ethiopian Electric Power Corporation, the Ethiopian Roads Authority and the Ethio-Djibouti Rail Way Company manage them.

Micro/Local level infrastructures are infrastructures which can be supplied and managed at the local level by local players like municipalities, local government departments, communities, CBOs and NGOs.

Integrated Infrastructure is a term used when different infrastructure interventions are planned and implemented in concert with one another, as well as to the urban activity they are meant to serve.

Drainage: the system for removing surplus water or liquid waste; drains "they set about renewing and repairing drainage and water supplies"

Culvert: A culvert is something that diverts water past an obstruction or to divert a underground stream. Typically buried so as to be encircled by earth, a culvert may be made of a pipe, reinforced concrete or other material. In the United Kingdom, the term can also be applied to a more extended artificially buried water course.

Lightening: Street light is a required element for city streets. It makes the city space vibrant during nighttime. It also increases the visibility of traffic signs and signals, lighting is expected wherever urban life goes on after dust.

Side Walk: Sidewalk are usually placed within the public light –of –way on either or both sides of the central road for vehicular use, within the marginal reserved strips.

Pedestrian Crossing: pedestrian crossing or crosswalk is an area on a road where some apparatus is installed to assist pedestrians wishing to cross.

1.8. Outline of the paper

The proposal is organized in such a way that the first chapter focuses on the introductory parts of the thesis. The second chapter provides the review of literature on the issue under discussion. In this chapter, the impacts, urban expansion on road infrastructure development of different country trends as well as the situation in our country during different period on urban expansion on road infrastructure development will reviewed. The third chapter describes the research methodology. The fourth chapter provides all result and analyze part. Also the fifth chapter concluded by findings, conclusion and recommendation.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

This section of the proposal briefly outlines the theoretical accumulated from the documents of others that are related to the impacts of urban expansion on road infrastructure development particularly in Lugo sub-city. It includes the theoretical concepts of urban expansion, condition of the existing road infrastructure, institutional challenges in the provision of road infrastructure and the impacts of urban expansion on road infrastructure developments and previous research findings on such subject areas, as well as best practices to show the empirical and theoretical framework of others. Subsequently, the researcher can draw research gap and conclusions from these previous findings.

A. Theoretical Literature Review

2.2. The Concepts of Urbanization

Cities are products of the process of urbanization. In other words, urbanization is the social process that leads to the creation of cities. Thus, the relationship between cities and urbanization is one of cause and effect. Urbanization is a very complex phenomenon, with my raid dimensions, which can be analyzed from various perspectives. Owing to the complex nature of this phenomenon, the study of urbanization is an enterprise that is being pursued by different disciplines. This has contributed to urbanization interdisciplinary in nature.

As per United Nations (2014), the process of urbanization describes a shift in a population from one that is dispersed across small rural settlements in which agriculture is the dominant economic activity towards one where the population is concentrated in larger, dense urban settlements characterized by industrial and service activities. Urbanization refers both to a condition at a point in time and to a process occurring over time. The condition of urbanization, referred to as its level of urbanization, is indicated by the percentage of a population that is living in urban areas, however defined. The process of urbanization has been used in several ways.

These include migration from rural areas to urban areas, absolute growth in the urban population (urban growth) and urban growth that is faster than rural growth.

Hence, urbanization as a process implies an increase in the percentage urban and the rate of urbanization, thus, refers to the growth rate in the level of urbanization. Urbanization refers to the population shift from rural to urban areas, "the gradual increase in the proportion of people living in urban areas", and the ways in which each society adapts to the change. The process whereby a society changes from a rural to an urban way of life (NLM, 2014). It is predicted that by 2050 about 64% of Africa and Asia and 86% of the developed world will be urbanized (The Economist, 2012). Notably, the United Nations has also recently projected that nearly all-global population growth from 2017 to 2030 will be absorbed by cities, about 1.1 billion new urbanites over the next 13 years. (Barney, 2015).

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2.2.1. Urbanization in Ethiopia

Urbanization in Ethiopia is a recent phenomenon conditioned by historical factors (Markakish, 1984). Ethiopia is characterized by low level of urbanization even by African standards, where Only 16percent of the populations live in urban areas (CSA, 2011) but the rate of growth is one of the highest in the world (UN, 2008). Such high growth rate; however, is not often accompanied by development in socio-economic services and infrastructure, and economic and employment capacity of the urban centers to support the growing population (Teller and Assefa, 2010).The establishment of many medium-sized towns in Ethiopia are in fact as a result of sociopolitical and military reasons (Markakish, 1984) and some due to the establishment of roads connecting Addis Ababa to different parts of the country and in some cases the construction of Ethio-Djibouti railway; whereby towns like Akaki, Bishoftu, Modjo and Adama were formed as urban-industrial complex (Ibid).

Apart from the different forms of urbanization and urban sprawl, urban centers surrounding Addis Ababa exhibit distinct features of urbanization; almost all urban centers surrounding the

capital exhibit common features of high land settlements, resultant decline in agricultural land and production, high rate of squatter settlements and informal land acquisitions, replacement of domestic economic activities, high rates of migration from different parts of the country, and out migration of inhabitants to the periphery are some of the major socio-economic changes.

The rate of urbanization, according to experts in the municipalities in eight studied towns ranges from 6 percent to as high as 10 percent; which is very high both at national and international level. This seems; however, less perceived by CSA mainly because the estimated current population of the towns is 196,585. Nonetheless, data gathered from the municipalities is 411,963, which is slightly twice more than the figure provided by CSA. CSA estimates based on mainly national and regional natural growth rates; however, migration is the leading factor apart from the regional and national average growth rates. A study conducted by Oromia Special Zone (2011) shows that the rate of migration in these eight towns on average is 21.8 percent. As a national phenomenon, studies suggest that migration play an important role for the urbanization of cities in Ethiopia. Although natural increase (births less deaths) is an important factor contributing to the growth of cities, rural–urban migration plays the leading role in the urbanization process (Teller and Assefa, 2010).

2.2.2. Causes of Urban Expansion

Urbanization is closely linked with transformation, industrialization, and sociological process of decision-making. Most of the rapid urban sprawl in developing nations is due to rural-urban migration (Free encyclopedia, 2010). According to (UN state report of the world population, 2007), urbanization occurs naturally from individual and corporate efforts to reduce time and expense in community and transportation while improving opportunities of jobs, educations, and housing and transportation statuses. However, major contributing factor is “rural flight”. In rural areas, often on small farms, it is difficult to improve one’s standard of living beyond basic subsistence’s particularly in developing countries case where rate of population growth outpaces resource production rate. To such communities, their farm is very much dependent on un predictable conditions such as drought flood and pestilences. Hence, people make decision to migrate to urban areas “rural flight”. This then contributes to urban pressure towards peri-urban lands. National wise, according to (Tagegne, 2001) two most important actors leading urban expansion are in-migration (both rural-urban migration and urban-urban migration) and natural population increase.

2.2.3. Trends of Urban Expansion

According to the (UN state of the world population report, 2007), sometime in the middle of 2007, the majority of people worldwide will be living in Citys or cities for the first time in history. This is referred to as the "arrival of urban millennium" or the "tripping point." With regard to trends, it is estimated that 93% of urban growth will occur in developing nations with 80% of urban growth occurring in Asia and Africa. Through this process of development, the report state that, from what it was 30% in 1950s, urban population will be 70% by 2050, globally. Reversely, the rural population becomes 30% by 2050 from what it was 70% in 1950.

Particularly, currently African average level of urbanization is 34% while the Ethiopia's is 18%, which is even very low in Africa. Different studies have projected that the proportion of urban population in Ethiopia will reach 23% by the year 2030 (MEDAC, 2002); (CSA, 1994). On the other hand, Ethiopia's urbanization rate is one of the highest in Africa. The average annual rate of growth from1960-1991 was 4.8 percent and this figure grew to 5.8 percent per-annum from1991-2000. This rate of growth puts Ethiopia among the 23 rapidly urbanizing counters of the world (Tegegne, 2001sitend, Lemma2020).

2.2.4. The Impacts of Urban Expansion

Urban expansion may involve both horizontal and vertical types of the expansion. The former refers to the extension of the Physical structure of the urban areas. Such process of urban expansion is a worldwide phenomenon, which can be seen in the history of all urban centers as to results in the loss of range posture and agricultural lands and natural beauties (Minwuyelet, 2004sited, Lemma 2020).

Urbanization and urban growth are considered as a modern way of life and centers of varieties of human opportunities, which all can highly contribute to socio-economic growth and development. However, as (Tegegne, 2000, sited, Lemma 2020) argues, horizontal expansion of urban areas in Ethiopia causes a number of socio-economic problems including tenure right violation. As to (Eyob, 2010), urban expansion in Ethiopia impedes the livelihood elements and strategies of peri-urban farmers' and hence leads them in to vulnerability compounded from trends, shocks and/ or their combination in a given context.

From these scholar findings, we can generalize that, while well planned and managed urban

expansion may enhances the common benefits of stakeholders, otherwise, the process leads to high negative externalities particularly to those peri-urban farmers by affecting their livelihood portfolios and strategies. Hence, whether negative or/and positive it is, urban expansion obviously has impact on natural, social, human, physical and financial assets (livelihood) of the peri-urban community as (Cemea,1997,Sitend, Lemma 2020) discusses.

2.3. Urban Land Use and Road Transportation

The land use and road transport have two elements; the nature of land use which relates to what is occurring where, and the level of spatial concentration, that is, their concentration and intensity. The central places have high levels of spatial concentration and similar land uses, for instance, retail, and the peripheral places have lower levels of concentration. The majority of social, cultural or economic activity contains a multitude of functions, such as production, consumption and distribution. These functions take place at locations and are part of a system. Some are everyday activities, owing to the fact that they occur on a daily basis and hence are predictable, for instance, shopping and commuting. The remainder are non-regular institutional activities that are determined either by lifestyle (e.g. sports and leisure) or by specific needs (e.g. healthcare).

Others are production activities related to manufacturing that involve distribution, the linkages of which may be local, regional or global. The land use is affected by the behavior of people, organizations and firms in terms of their locational preference. Chan, Y. (2005).

Whereas supplier relationships will be dominated by freight movements, customer relationships would entail people movements. Thus, some level of access to both circulation systems must exist. Since each type of land use has its specific mobility requirements, transport is an activity location factor, and thus is inextricably bound up with land use. Within an urban system, each activity assumes a suitable, if not optimal, position from which it draws rent. Land use and transport interactions in large part explain the retroactive relationships between activities, which are land use based, and accessibility, which is transport based. These interactions have also been termed a classic "chicken-and-egg" problem since it is difficult to identify the causative agent of change; do transportation changes precede land use changes or vice-versa. Rodrigue, J-P (2013).

There is a scale effect here because large infrastructure projects do come before and bring about land use change while small-scale transport proposals do supplement the existing land use pattern. Moreover, the development of urban land uses takes place over various settings like infilling (near the city centre) or sprawl (far from the city centre) and where transport plays another role in each case. Urban transportation is aimed at serving the transport demands generated by the variety of

urban activities in a variety of urban contexts. One of the keys to the secrets of urban organisms is thus in the study of urban land use transport processes and patterns. The system is extremely complex and involves a series of relationships between the transport system, land use, and space interactions. A puzzle concerns the problem of linking a specific mode of transportation to specific land-use patterns. While public transit systems are typically associated with higher residential and commercial densities and highways with lower densities, the array of modes found in urban areas, including freight distribution, manifests an unclear and complex relationship.

Urban Land Use Models Transport-land use relations are theoretically dense in representations that have also made contributions to regional sciences. Since transportation is a distance-decay changing technology, spatial organization is said to be strongly determined by the concepts of location and distance. Several descriptive and analytical urban land use models have been developed over the years, with differing degrees of complexity. All have some consideration of transport within the urban land use pattern descriptions. The following is a non-exhaustive list. Ye, X., R.M. Pendyalaa and G. Gottardi (2007).

2.3.1. Central Places and Concentric Land use Model

Von Thunen's regional land use model is the oldest representation based on a central place, the market City, and its concentric impacts on surrounding land uses. It was initially developed in the early 19^{th} century (1826) for the analysis of agricultural land use patterns in Germany. It used the concept of economic rent to explain a spatial organization where different agricultural activities are competing for the usage of land. The underlying principles of this model have been the foundation of many others where economic considerations, namely land rent and distance-decay, are incorporated. The core assumption of the model is that agricultural land use is patterned in the form of concentric circles around a market that consumes all the surplus production, which must be transported. Many concordances of this model with reality have been found, notably in North America. Chan, Y. (2005).

2.3.2. Cellular Automata

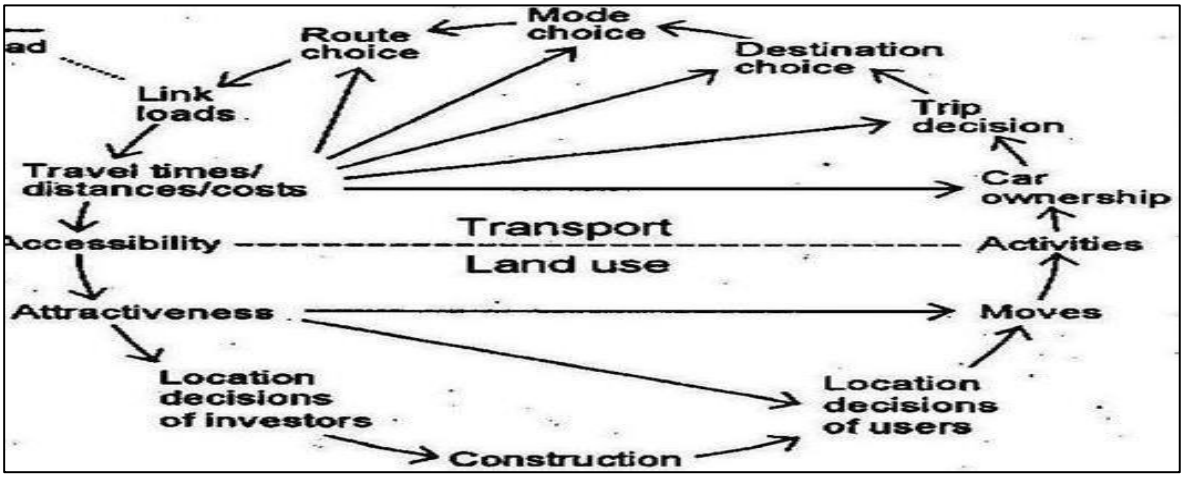
The dynamic of land use models developed on the principle that space can be represented as a grid where each cell is a discrete land use unit. Cell states thus symbolize land uses and transition rules express the likelihood of a change from one land use state to another. Because cells are symbolically connected and interrelated (e.g. adjacency), models can be used to investigate the dynamics, evolution, and self-organization of cellar automata land use systems. The cellular

approach enables to achieve a high level of spatial detail (resolution) and realism, as well as to link the simulation directly to visible outcomes on the regional spatial structure. They are also readily implementable since Geographic Information Systems are designed to work effectively with grid-based spatial representations.

A cellular automaton improves upon most transportation land use models that are essentially static as they explain land use patterns, but they do not explicitly consider the processes that are creating or changing them. The applicability and dynamics of land use models is related to issues such as the age, size and the locational setting of a city. For instance, concentric cities are generally older and of smaller size, while polycentric cities are larger and relate to urban development processes that took place more recently. While most of the conceptual approaches related to transportation and land use relationships have been developed, using empirical evidence related to North America and Western Europe, this perspective does not necessarily apply to other parts of the world.

A dualism in land uses has been observed in cities in developing countries where on one hand processes such as economic development and motorization are creating an urban landscape, which is common in advanced economies. On the other hand, an informal landscape of shanty cities represents a land use structure that is not effectively captured by conventional land use models. It remains to be seen to what extent globalization will favor a convergence of land use patterns across the world's cities. Transportation and Urban Dynamics Both land use and transportation.

Figure 2: Conceptual Frameworks



Source:-Landis, 1995

Are part of a dynamic system that is subject to external influences? Each component of the system is constantly evolving due to changes in technology, policy, economics, demographics and even culture or values. As a result, the interactions between land use and transportation are played out as the outcome of the many decisions made by residents, businesses and governments. The field of urban dynamics has expended the scope of conventional land use models, which tended to be descriptive, by trying to consider relationships behind the evolution of the urban spatial structure. This has led to a complex modeling framework, including a wide variety of components. Among the concepts supporting urban dynamic representations are retroactions, whereby one-component changes it influences others. The changes will influence the initial component back, either positively or negatively. (*Landis, D 2010)*

2.4. Urban Structure and Urban Growth

Urban land use planning plays a vital role in bringing a balanced and sustainable urban development. In developing countries, the conceptual frameworks on urban road transportation problems relate road transportation to urban land use. Indeed, road transportation is regarded as the heart of urban land-use function. The intimate relationship between transportation and land-use is acknowledged by the fact that at the heart of every city's master plan is a long-run transportation network (Hoyt cited in Moges, 2008). The distribution of land uses within a city varies greatly and determines the transportation requirements. Transportation and land-use interactions, mostly consider the retroactive relationships between activities, which are, land use-related and accessibility, which is transportation, related. These relationships have often been

Described as a classic, chicken-and-egg problem since it is difficult to identify the triggering cause of the change.

Urban structure is the arrangement of land use in urban areas. Urban planners, economists and geographers have developed several models that explain where different types of people and businesses tend to exist within the urban setting. Urban structure can also refer to urban spatial structure, which concerns the arrangement of public and private space in cities and the degree of connectivity and accessibility.

The term "urban form" is used to describe a city's physical characteristics. It refers to the size, shape, and configuration of an urban area or its parts. How it will be understood, structured or analyzed depends on scale. Characteristics of the urban form range from at a much-localized scale, features such as building materials, facades and fenestration to at a broader scale, housing type, street type, and their spatial arrangement or layout.

2.5. Urban Road Infrastructure in Ethiopia and Policy Issue

2.5.1. Urbanization and Road Infrastructure

According to Alula, in his studies (2006 sited in Andualem, 2008), road infrastructure has been one of the prime factors behind the genesis and the growth of many Citys in Ethiopia. Hence, both urbanization and urban development has been substantially patterned road transport**.** In Ethiopia many settlements were developed following road development. Many illegal settlements were established on the lines of interurban interconnections**.**

Large-scale spatial planning and urban development projects are increasingly becoming popular in transforming landscapes in rapidly urbanizing cities of the Global South. Most governments in the Global South are using such projects to scale up their cities' competitiveness, requiring structuring and re-structuring of their road networks, and in return, attract investments. These large-scale projects, for instance road infrastructure projects, touch on multiple stakeholders, possibly leading to all kinds of changes in adjacent areas (Erkul et al. **2016**; Oviedo Hernandez and Dávila **2016**). However, the attempt of scaling- up the city and making it competitive sometimes fails to consider the needs of the affected citizens during the infrastructural development (Brussel et al. **2019**; Aoun **2016**). Construction of roads, whether new or upgrading of existing ones, is presumed to have a range of impacts on the population, urban form,

economic status and environment (Mackett and Edwards **1998**). The impacts may be both positive and negative depending on the situated social, spatial, economic and environmental context.

2.5.2. Urban Development Policy and Road Infrastructure in Ethiopia

In the federal urban development policy, road construction is given the second priority next to the water supply in urban areas. The policy document underlines the essential to provide internal gravel road to allow taxi and ambulance services According to the policy documents major roads should be covered with asphalt surfaces as much as possible. Therefore, the focus of urban administration in this regards should be to continuously work on standard roads that match the urban plan and strengthening system for maintenance and pedestrian pathways.

The Ethiopian economy is highly characterized by following tight fiscal and monetary policy. According to Admit, et.al (2014) the government continued to pursue prudent fiscal policy better coordinated with monetary policy to combat inflation, while maintaining the momentum of spending in physical and social infrastructure. One study examine prospects and perspective of infrastructure development and economic growth in India (Srinivasu and Srinivasa Rao, 2013), the result showed that, infrastructure is the prerequisite for the development of an economy. Moreover, infrastructure plays a crucial role in promoting economic growth and thereby contributes to the reduction of economic disparity, poverty and deprivation in a country. This study establishes the relationship empirically using growth theories and indicators of investment in transport, power, communication and informatics, education, and health, which strongly influence the quality of life of the people.

2.6. Problems of Urbanization

2.6.1. Major Problems in Road Infrastructure Development

According to Dennis, (2001), the major problems facing in road infrastructure are lack of physical access, lack of physical planning, inappropriate technology, inadequate consultation socio economic constraints, low community participation and lack of sufficient information. Specially, for low income a community that is common to developing nations, certain problems are influenced by the utility and demonstrate that proper management, efficient and effective service delivery plays a leading role in improving access and affordability of low-income consumers. These include poor

payment of bills, which are influenced by late billing and unreliable service as well as unreliable consumer data (Dennis 2001).

One of the main problems of urbanization is road infrastructure developments problems are. There are two main dimensions to the problem of urban road infrastructure development: quantity and quality. Cities need a lot of road infrastructure provision. More important the demand towards road infrastructure has increased dramatically.

2.7. The Impacts of Urban Expansion of Road Network

The spatial expansion and land use change in the world seem to be catalyzed by the transport infrastructure development and population growth has affected travel over time. The impacts of urban expansion on road infrastructure development have been further investigated by relating some urban growth indicators (population growth, urban spatial expansion, residential, institutional and industrial area growth (Landis, 1995)**.**

Road plays a significant role in realizing economic development, social network and relation, attraction and expansion of investment. Road network is essential with time saving perspectives, minimizing traveling distances and improve services in trade, education and health sectors (Ladd, 1994).

Shlome et al, (2005), urban expansion have impacts on the cost of investment, it increases the infrastructure cost associated with expansion. In addition to this (Cox and Utt, 2004), argued that a fundamental characteristic of urban expansion is that there are two sets of road infrastructure. The dual cost is the one providing new road infrastructure for those moving outward and the second is maintaining the old road infrastructure for the population and economic entities left behind. On the other hands the rapid expansion of the urban area that have created a great impacts on the development of road networks, the local government is mainly focused on the expansion of the City without considering its impacts on road infrastructure development.

Due to its expansion, there is lack of construction of classified roads. The main paved road network is much lower than the demand. The maintenance, upgrading and provision of road are not enough in the City**.** In addition to this the City has witnessed a dramatic increase in population size, the increase the income level of population and a wide spread of the economy are increasingly straining the City road infrastructure demand. The impacts of accelerated urban expansion, population growth and the supply and demand sides of road infrastructure are the

main agenda and the municipality of Adama City. In general, urban expansion affects road development in the following ways;

Road infrastructure projects have massive investments since they have been used to achieve economic prosperity through haulage of goods and services from one place to another (Jedwab and Moradi 2016). In Sub-Sahara Africa, road infrastructure presently remains the means of conveying about 75% of freights and passengers (Beuran et al. 2015). Considering that about 50% of the roads in the Sub-Sahara region are yet to be constructed implies that road infrastructure development remains on the top list of physical infrastructure developments in such cities, potentially impacting the socio-economic and physical environment of the cities and their peri-urban areas (Gachassin et al. 2010; Cobbinah et al. 2015).

From a historical point of view of the Global South countries, especially Kenya and Ghana, transportation infrastructures show some contrasting outcomes though with a few similar scenarios. In both countries, road infrastructure projects are on the increase resulting in social and spatial heterogeneities, particularly within the peri-urban areas. These include growing inequalities, exclusion, housing, safety and security (UN-Habitat 2016). This has also led to competition between newcomers and old inhabitants for land and other natural resources, thus affecting living conditions, especially of the very poor (Yankson and Gough 1999; ASIRT 2014).

2.7.1. Cost of Investment

Infrastructure contributed 0.6 percentage points to Ethiopia's annual per capita GDP growth over the last decade. Raising the country's infrastructure endowment to that of the region's middle-income countries could add an additional 3 percentage points to infrastructure's contribution to growth. Ethiopia's infrastructure successes include developing Ethiopia Airlines, a leading regional carrier; upgrading its network of trunk roads; and rapidly expanding access to water and sanitation. The country's greatest infrastructure challenge lies in the power sector, where a further 8,700 megawatts of generating plant are needed over the next decade, implying a doubling of current capacity. The transport sector faces the challenges of low levels of rural accessibility and inadequate road maintenance. Ethiopia's ICT sector currently suffers from a poor institutional and regulatory framework. Addressing Ethiopia's infrastructure deficit will require a sustained annual expenditure of $5.1 billion over the next decade. The power sector alone requires $3.3 billion annually, with $1 billion needed to facilitate regional power trading.

That level of spending represents 40 percent of the country's GDP and a tripling of the $1.3 billion spent annually in the mid-2000s. As of 2006, there was an annual funding gap of $3.5 billion. Improving road maintenance, removing inefficiencies in power (notably underpricing), and privatizing ICT services could shrink the gap. However, Ethiopia needs a significant increase in its already proportionally high infrastructure funding and careful handling of public and private investments if it is to reach its infrastructure targets within a reasonable time. Investment in infrastructure in general, and in transport infrastructure in particular, is seen as a crucial prerequisite for sustainable economic development. This common belief is reflected in a strong emphasis on the part of all donors, especially those of multilateral aid. World Bank lending to Africa for these sectors amounted to US$3.3billion in 2009, which is a doubling of infrastructure aid since 2006 (Hannah, 2014).

The developing world, and especially the African continent, has a very poorly developed infrastructure, compared to middle- and high-income countries. On average, Sub-Saharan Africa has a road density of only approximately 200meters of paved roads per km2 compared to 1400 meters in high-income OECD countries (ibid).

Ethiopia is a land locked country where the major share of passenger and freight movement is by means of road transport and where the transport network is recognized as a major bottleneck. As the government of Ethiopia cognized the role-played by road infrastructure in economic development and poverty reduction, the country has undergone rapid expansion in road infrastructure since 1997 as the result of the Road Sector Development Program (RSDP). Massive amount of capital has been invested by the government with the support of international donors for the provision of all-weather roads that improve regional connectivity (ERA, 2014).

2.7.2. Compensation Payment

Urban expansion takes a huge amount of money for road infrastructure investment, which is considered as wastage. The place will be demolished one day and taking with it all the money invested. It is associated with the land and property cost for land acquisition of developed urban road infrastructure. In the study area, it is characterized by dilapidation of old houses and business centers; in addition to this, the pattern of the City is in an unplanned manner. If the local government wishes to develop additional road it will incur costs, to clear the old and unplanned houses, which are near to the road, and center to the road.

According to FAO, (2008) in order to bring sustainable development governments should provide public facilities and infrastructure that ensure the wellbeing and safety of the society, and safeguard and refurbishment of the natural environment. One of infrastructure facility is road transport, which plays a function of both production and consumption. Furthermore, roads can integrate other form of transportation. Provision of road for an urban area is the remedy for development and mostly performed by expropriation of private landholders through compensation. The purpose of expropriations not mostly for private use rather it is of public interest. During expropriation individual right like the right to develop, use, and access are violated, though there might be differences from country to country in the context of their legal framework. For these reasons, compensations become one phenomenon to respect the right of the landholders. In countries that deliver expropriation, compensation faces challenges in relation to the amount that should be compensated; and even though the amounts in legal aspects may be fair, they faced implementation and cultural attached problems.

According to Ibrahim (2011) in his term paper Vol-004, In Ethiopia the dominant mode is road transport, which accounts for 90 to 95% of power-driven interurban freight and passenger movements. However, road networks are limited and created difficulty in the provision of infrastructure for undertaking towards socioeconomic development, and poverty reduction (ERA, 2008aas sited in Ibrahim, 2011). In order to reduce poverty and facilitate the day-to-day activity, road development is essential. The first task before providing facilities and infrastructural services is acquisition of appropriate land (FAO, 2008).

In Ethiopia expropriation becomes one of the issues related to urban redevelopment, but little for road construction. The government of Ethiopia formulates different policy and strategies in relation to have clear, fair, and accountable implementation procedures. In these parts expropriation and compensation is one activity that takes place in order to benefit public (Proclamation455/2005). This big task of expropriation and compensation are delivered by authorized body or parts of government organs as if municipalities (Proclamation No. 35/2012).This regulation incorporates compensation, but does not fully been implemented. In addition, for fully expropriates the value at the center are not equal with the transitional zone; for partially expropriated the compensation amount is not fair. These make the expropriated landholders to oppose the compensation values. The other problem is human resource capacity

building such as lack of trainings and full human resource.

2.7.3. Social Impacts of Urban Expansion

Urban expansion causes displacement, dislocation and segregation that result in social fabrics disorder. People in the extended urban areas "live still partly rural and where many of the Residents live in the country, but are not socially and economically on it" (Carter, 1995). They usually do not participate in the planning and design of resettlement and dislocation options as well as the distribution of associated costs or benefits. Since social infrastructure is concentrated in, the central people in the extended area rely on proximity to facilities.

This involves a long commute to work, market and other basic social needs. Low-income households will continue to live in such sever social constraints in the periphery. There is also a possibility of isolation from the city development and sandwiched between the rich creating class difference. This began to accelerate the migration of the disadvantaged groups, particularly the farming community who already inhabited the area. Even urban rich or middle class incomes whose income permits to commute, perhaps many could be attracted to the liveliness and benefits of the facilities in the center. Thus, the community in the periphery could face problems of survival strategies, solidarity networks, and systems of power to which the social and economic activities are linked to their original location (Mejia, 1999).

Urban expansion may involve both horizontal and vertical types of the expansion. The former refers to the extension of the Physical structure of the urban areas. Such process of urban expansion is a worldwide phenomenon, which can be seen in the history of all urban centers as to results in the loss of range posture and agricultural lands and natural beauties (Minwuyelet, 2004).

Urbanization and urban growth are considered as a modern way of life and centers of varieties of human opportunities, which all can highly contribute to socio-economic growth and development. However, as (Tegegne, 2000) argues, horizontal expansion of urban areas in Ethiopia causes a number of socio-economic problems including tenure right violation. As to (Eyob, 2010), urban expansion in Ethiopia impedes the livelihood elements and strategies of peri-urban farmers' and hence leads them in to vulnerability compounded from trends, shocks and/ or their combination in a given context.

2.7.4. Topography

Urban expansion increases the demand towards road infrastructures; but it is limited by different factors, among this topography is the one, which increases the cost of investment for road network development. The up and down of the features, marshes are the main issues with the development of road Adama City, Lugo Sub-city is facing several problems in road infrastructure development, such as rigged topography and marshes, lack of skilled manpower, inadequate maintenance, awareness about sustainability and institutional challenges are the major ones.

2.7.5. Environmental Consequences of Urban Expansion

Spatial-temporal urban expansion nowadays attracts the attention of many-concerned body particularly the local organs like the municipality following the environmental change linked with urban population growth (Mandal, 2000). It has adverse effects on environment of urban areas and peripheral parts by encroaching productive and fertile agricultural farmland and forest. Lwasa (1999), discussed the cause of Kampala and the expansion of city was occurring at the expense of the environment in and around the city. Additionally, Shuqing et al (2005) has studied ecological consequences of rapid urban expansion in shangai city of china and concluded that land use and land cover in Shangai have been greatly altered air pollution is consistently highest in urban areas which indicates strong negative effect of major urban development on air quality.

B. Empirical Literature Review

2.8. Lessons from International Experience and Cases

For the purpose of this thesis, case studies are selected. Best practice in planning and defining municipal road infrastructure needs in Canada. This case is taken from the studies of, World Bank (2010). The essence of the review of these cases is to learn from international experience. This helps the researcher to conceptualize at the local level of Adama City, which faced a road provision and upgrading costs.

2.8.1. Best Practice in Planning and Defining Municipal Road Infrastructure Need in Canada

This best practice focuses on planning and defining municipal infrastructure needs, specifically road infrastructure. Good planning methods promote efficient and effective municipal spending by providing a framework to focus financial and staff resources where they are most needed. These methods facilitate the sustainability of municipal infrastructure, which, in turn, maintains a

certain level of provided service.

Planning and defining methods follow an overall corporate vision and are vital in managing municipal infrastructure needs for the long term, especially in communities experiencing population growth, ageing infrastructure or those that aim to have sustainable infrastructure. A capital infrastructure plan integrated with land use and financial plans, and corporate business plans is increasingly seen as key to successful strategic planning.

Some of the municipalities surveyed indicated that a lack of cohesion in departmental decision-making (and potentially efficient and effective spending) was a result of insufficient links between departments and strategic or corporate planning activities. High-level goals for levels of service in roads, for example, should be directly correlated to departmental prioritization targets. Methods for planning and defining municipal infrastructure needs have been identified as a useful best practice for achieving sustainable infrastructure, because current infrastructure needs are not being addressed in many Canadian municipalities.

Planning for, and defining, infrastructure goals can assist in co-coordinating infrastructure needs and municipal finance priorities. Integrated planning can shape and influence the type of growth that occurs and where it occurs. It can also optimize or maximize the use of existing infrastructure (i.e., infill and compact design goals in land use plans with related instruments to target development in certain areas), as well as plan for optimal rehabilitation of infrastructure. Planning and defining methods can also manage the demand on infrastructure through the establishment of good programs to change user behavior (i.e., promoting alternative transportation such as public transit, cycling, or rail to manage road infrastructure demand.

There are five methods within this practice of potential interest to municipalities that allow municipalities to develop, analyze, communicate and present the needs for infrastructure, and to incorporate economic, social and environmental issues into the long-term, strategic planning for infrastructure. The key to successful implementation of a strategic planning document is to integrate it within all aspects of municipal decision-making. This best practice gives

municipalities the basics for developing, analyzing, communicating and presenting the needs for infrastructure, and incorporating economic, social and environmental issues into the long-term, strategic planning for road infrastructure. In general, the success of the best practice is widely focused on seven knowledge areas these are;

1. Strategic planning
2. Information Management
3. Building public support and Acceptance
4. Exploring new and innovative methods for continuous improvements
5. Prioritization Model: Weighting and Ranking systems
6. Prioritization model: Linking capitals with operation and monitoring budget in the planning.
7. Prioritization Model: Business Case Approach

2.9. Research Gap

Different research findings did not contravene each other rather the researchers try to address their respective research objectives adequately with respect to the impacts of urban expansion on road infrastructure development in general and give us inputs for further research to study in the same area. However, due to the specific concerns of the researchers and funding institutions, all previous findings tends to show urban growth without giving due considerations of its impacts on road infrastructure development.

In general different scholar's findings and debates at different times are summarized as, Aguayo, Allen, Bruckner, Hennriquez, and Herold (2006).They have discussed the cause of urban expansion and this study have been conducted to understand urban growth phenomenon. At the same time as in Ethiopia, Berhanu (2005), investigated the impacts of urban development on the livelihood of displaced people, in Cazanchis he found that urban expansion have a negative impacts towards the socio-economy of community; but the impacts of urbanization on road infrastructure is not given due emphasize by the researchers. Actually, the urban expansion is meaningless without effective road infrastructure development. Hence, the researcher will assess to the impact of urban expansion on road infrastructure development to fill the gap what was not emphasized by previous researcher.

CHAPTER THREE

3. RESEARCH METHODOLOGY

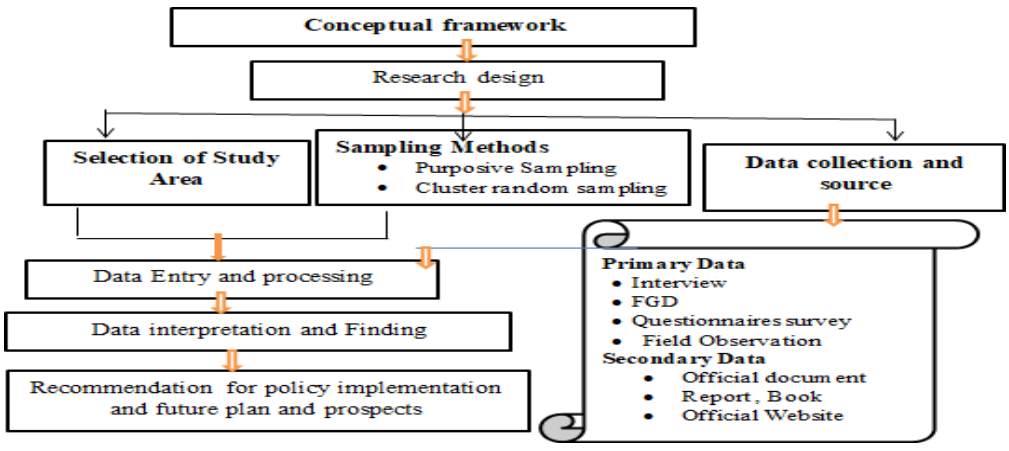
3.1. Introduction

This chapter deals with the explanation of research methodology. The study employed series of actions in collecting necessary information to answer the problem statement of the study. The methodology of the research work include the general approach of research design, sampling design like population, sampling frame, sampling unit and ample size. The relevant data is gathered using mixed method techniques of both qualitative and quantitative data from primary and secondary data sources.

3.2. Research Design

The study used both explanatory and descriptive research types. The explanatory research methods were enabled the researcher to understand the impacts that hinder the real provision of road network expansion in the town. On the other hand, the descriptive research type were used to describe the existing situation of road infrastructure provision and the characteristics of the research population in the City. In order to analyze this relation survey method types will be employed, the study were analyzed the impacts of urban expansion on road infrastructure provision in the Adama City, Lugo sub-city as a case study. The study were applied cross sectional studies, because it measures the samples at one time point.

Figure 3: Conceptual Framework of research design



3.3. Research Approach

The nature of a study determines the approach by which the research is to be conducted. The research approaches are quantitative and qualitative. In the case of this research, the approach to urban expansion on road infrastructure development practices is dominantly qualitative but not limited to it. Achieving the expected goal requires both qualitative and quantitative-based information from the dwellers in the city, the municipality, and urban development department, and the regional urban planning institute as well as from other sources. A qualitative approach is used to collect the required and reliable information for the study since it uses multiple sources of data such as interviews, observation, and documents. Quantitative research yields objective facts that may be expressed using statistics and numbers.

3.4. Sampling Technique

The researcher used both probability sampling and non-probability sampling approaches. As a result, among the techniques of probability sampling approach, cluster random sampling, and non-probability one, the researcher used a purposive sampling technique method.

3.3.1. Sampling size

The number of the sample size of the study is limited to 168 respondents and interviewees will made with 14 City officials. The samples will be selected from the target population of the three woredas and municipality document to get household units. Thus, the researcher will be use Simple random sampling techniques to get 168 respondents by using the formula N/n, and it is possible to select the sample size out of the sample population record lists.

In addition, 14 respondents, 3 officials from City administration, 2 from mayor office, 3 from municipality, 3 from land development and management office and 6 from both woreda offices (2 from each woredas) will purposively interviewed to get relevant information.

The sample size will be calculated using Kothari (2007), formula Therefore, the researcher used the formula:

$$N= Z^2pq/ \{2 (N-1) +Z^2 pp.\}$$

Since N (17,668) is greater than 10,000, with 93% confidence level (1.81), to get the desired sample size (n).

N is the population size,

n=the desired sample size,

Z= the standard normal variable at required confidence level (93%),

p= the proportion in the target population estimated to have characteristic being addressed (50%).

q=1-p and e = the levels of statistical significance set.

Therefore, the sample size (n) would be calculated as follows.

$N=Z^2pq/\{e^2(N-1)+Z^2pq\}$

e= (1-0.93) x 100%= 5%=0.07, p=0.5, q=1-p=1-0.5=0.5

$n=Z^2N/(e^2(N-1)+Z^2.p.q)=(1.81)^2$x 150,374 *(0.5)*(0.5)/$(0.07)^2$(150,374 -1)+$(1.81)^2$* (0.5)*(0.5)

=3.2761x51,374x0.5x0.5=123,160.0653/737.6467

=166.96 '≒168, and 14 from sectors which is 182 in total.

Moreover, the concerned body of local officials is taking interview to elaborate on the problem and measures will be taken, therefore;

Table 1:Sample Size of residents per Woreda

Woreda	Total HHs	Sample size per Woredas	Method of Selection
Barrecha	78,480	(78,480/150,374)*168=88	Cluster Random sampling
Dirre Nagaha	50,192	(50,192/150,374)*168=56	
Migira	21,702	(21,702/150,374)*168=24	
Total	150,374		

Source: OUPI demographic study report 2025 and researcher analysis

The researcher adopted the Purposive sampling strategy because it helps to get the most out of a small population of interest and produce useful study results. Purposive sampling enables the researcher to collect qualitative replies, resulting in deeper insights and more precise study outcomes, as well as obtain sufficient data. The data for this study will draw from two target groups. The first target group is residents; the second is the Office selected by the researcher that is concerned with urban expansion and Road infrastructural provision (Adama city Administration, Land Administration office, Municipality, infrastructure sector).

3.3.2. Sampling Unit

Among 150,374 households, the sampling unit is about 168 households from residents and 14 key informants from government sectors, which become 182 units within the city.

In addition, 14 key informants are taken for interview from the Municipality, Road and transport Authority, Industry and urban development, land administration office, Construction Department and woreda official.

3.5. Method of Data Collection

3.5.1. Sources of Data

There are two types of data, namely primary and secondary sources of data. The researcher utilized both types of data to make an objective assessment of the Impacts of urban expansion on road infrastructure development in Lugo Sub-City, Adama City.

3.5.2. Primary Data Source

The primary data in this research will be collect from City Administration, land management office, the Municipality of Lugo Sub-City, Adama City, heads of dislocated farm households, and other actors by using in-depth interviews and structured questionnaires. In addition, direct field observation by the researcher conducted to collect first-hand information regarding livelihoods.

3.5.3. Secondary Data Source

Secondary data was also obtain from multi-spectral images, GIS data, and Structural plan of the City and obtains from the review of related literature (i.e. relevant information from research, the secondary data uses for the study will collect from various organizations such as Geo spatial information institute of Ethiopia and Lugo Sub-City, Adama City urban Land administration and use office). Additionally, the U.S. Geological Survey (USGS) is a free gold mine of information and the recognized source of satellite image spanning wide areas.

3.5.4. Techniques of Data Collection

The data will collect from both primary and secondary data sources. The primary data will collect from respondents through observations, questionnaires, and interviews and besides, the secondary data will collect from different published and unpublished documents, internet, Journals and different sectors annual report related to the study in Lugo Sub-City, Adama City.

Questionnaires: questionnaire is a document that is methodically planned having a set of questions intentionally made to obtain answers from research informants mainly for the collection of data. Questionnaires are preferred in the study because they give respondents complete freedom of response and are applicable even to the uneducated person. Thus, open ended and closed ended questionnaire will developed based on the objectives of the study.

Interviews: an interview is an interaction between an interviewer and interviewee which the interviewer using a guideline orally asks and interviewee questions to obtain data. This study conducted structured, semi-structured and unstructured interview. The interviews were applied to obtain information from officials and professionals, City administration, City land development and management offices and municipality.

Field Observation: observation is an instrument characterized by a prolonged time of social interaction between the researcher and the area under study, during which data in the form of direct field observation, notes are taken without asking questions. It is more focused on the researcher watching (viewing) and listening study elements and taking notes. It also enabled the researcher to see the practical developments and the reality on the ground. In addition, digital camera will applied to take the photos on the availability and accessibility of road infrastructure developments.

3.6. Tools and software programs

The research emphasizes the analysis the impacts of urban expansion and on Road Infrastructure Development. Arc GIS 10.8 software and SPSS software are used for this study. Arc GIS 10.8 software uses to do spatial analysis, data processing and produce map output.

3.7. Data analysis

After all the pre-processing operations, one of the study's actual works will be image classification, which is the basis for analysis of land use-land change and quantification and analysis of spatiotemporal urban expansion. Therefore, supervised image classification with maximum likelihood classifier will be used for this study among different image classification methods. The rationale behind using this method is the most powerful classification algorithm as long as accurate training data are provided and certain assumptions regarding class distribution are valid (Anand, 2018). In addition, its most widely used classification methods in many urban expansion studies (Berhanu, 2017; Sewunet, 2017; Zhang, 2016).Modification of the Anderson Level I scheme will be used to define the land use classification, nomenclature (Anderson et al., 1976). This process has been used in several studies for land use class determination (Sewunet, 2017; Zhang, 2016). Therefore, this study will use five categories of land use: Built-up Area, Agricultural Land, Vegetation, Barren Land / Open Space and Water Body.

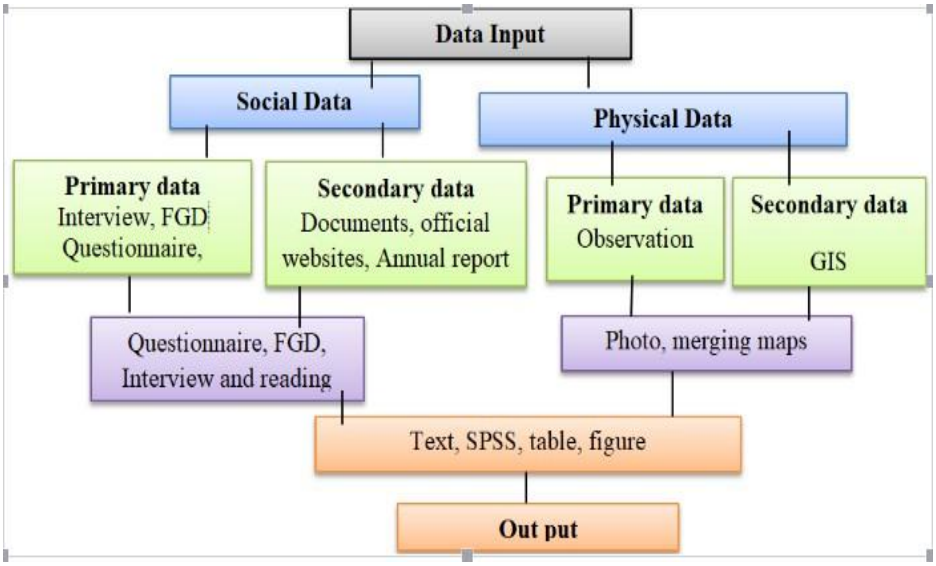
The classification will be made in all of 1998, 2008 and 2018 images, so that a comparison can be made. To analyze and quantify the configuration of the land cape during the urbanization process, urban land use will be reclassified as a built-up and non-built area. An Accuracy assessment will be carrying out to test the validity of the Classified Image. Change detection analysis will be carried out for each category of land use. Shannon's entropy will be used to calculate the degree of urban expansion by using a multiple ring buffer analysis tool in the Arc GIS environment. Landscape metric analysis will be computed to quantify and quantify landscape configuration during the urbanization process. To assess the impact of urban expansion on urban provision service such as road, health service, water facility and school

Facilities, service area coverage analysis will be done by employing network analyst toolset of ARCGIS tool. In addition, the result will be displayed using maps, charts and graphs.

For saving time and ease analysis, and the researcher format will prepare and compiles the data to feed into a computer for analysis the researcher will use statistical software such as SPSS. ARC GIS Software and the master plan of the City to end with the analysis, the data are

presented using, tables, figures, diagrams and graphs maps and photos. Moreover, quantitative outputs such as percentages, frequencies, and averages are used for further interpretations. The qualitative data findings are discussed and narrates thoroughly too forward necessary information adequately which shows cause and effect relationship.

Figure 4: The general method of data analysis



Source: - Adopted, *2024*

3.8. Descriptive Analysis

Descriptive analysis can be used to reduce the data into a summary format by tabulation and measures of central tendency. Moreover, pie charts, table and graphs will use to illustrate the general character of households. The motive for by means of descriptive statistics will be to compare the factors under the study. As well, the interview questions will analyze by using descriptive narrations through simultaneous triangulation.

3.9. Validity and Reliability and Practicability

Validity: is the extent to which the research instrument allows us to get the correct information. The researcher will try to maintain the validity of the data by applying different methods to

Collect information on the same topic from different sources by using techniques such as in-depth interviews, and questionnaire, Field observations and that are helping in triangulating the information. On the other hand, to maintain the reliability of the data the researcher is conducts pre-testing and the researcher himself directly does translating the questionnaire as well as enumeration.

Reliability: the researcher will ensure the reliability of the research, a researcher will conducts pre-testing and translating the questionnaire as well as enumeration will directly done by the researcher himself.

Practicability: the topic the researcher selected is practically possible to conduct research with state geographical and thematic delimitation in terms of money, time and convince.

Ethical Considerations: all participants would be informed of the study's objectives, their role in the research, and their right to confidentiality. Written informed consent would be obtained from all interview and survey participants. Personal information would be kept confidential, and all data would be anonymized to protect participants' privacy. Participation in the study would be voluntary, with participants free to withdraw at any stage without any negative consequences.

CHAPTER FOUR

RESULTS, INTERPRETATION AND DISCUSSION

4.1. Introduction

Adama City is one of the oldest, most populous, and rapidly growing urban centers in the Oromia region of Ethiopia. Renowned as a hub for trade, industry, and communication, it serves as a key junction connecting cities in the eastern and southern parts of the country and is characterized by diverse topographic features. Despite these advantages, there exists a noticeable mismatch between the pace of urban expansion and the provision of road infrastructure, particularly in Lugo Sub-City. To address this issue and achieve the study's objectives, the researcher gathered and analyzed both primary and secondary data from a variety of sources.

4.2. Response Rate of the Sample Households

Given that urban expansion affects both residents and the development of urban road infrastructure, the researcher included a diverse sample of households representing various socio-economic and demographic backgrounds. Although the study initially planned to distribute questionnaires to 182 households, 174 responses were successfully collected resulting in a 95.6% response rate. These responses provided sufficient information aligned with the study's objectives. Therefore, the response rate is considered reliable and representative of the city's population, consistent with the study's 93% confidence level as outlined in the methodology section.

4.3. Profile of the Respondents

Table 2: Woreda Population and Area Coverage

SN	Woreda	Area in Ha	Population
1	Barrecha	414.64	78,480
2	Dirree Nagaha	641.69	50,192
3	Migira	451. 72	21,702
	Total	***1,579.33***	***150,374***

Source: OUPI, Structure Plan Demographic study 2024

Table 3: Socio-economic and Demographic Characteristics of Sample Households

Variables	Category	Frequency	Percentage
Woreda	Dire Nagaha	58	33.33
	Barecha	90	51.72

	Migira	26	14.94
	Total	174	100
Age	<18	9	5.8
	18-30	44	28.6
	31-50	81	51.6
	>50	20	12.98
	Total	174	100
Sex	Male	138	79.31
	Female	36	20.69
	Total	174	100
Education	1-8	2	1.3
	9-10	42	27.3
	11-12	14	9.09
	Certificate	28	18.2
	Diploma	37	24.02
	Degree	31	20.12
	Total	174	100
Occupational Status	Business owner	53	34.4
	Private Employee	12	7.8
	Government employee	47	30.5
	Un employed	42	27.3
	Total	174	100
Staying years of the respondents	<5	5	3.2
	5-9	26	16.88
	10-14	41	26.6
	15-18	18	11.6
	>19	64	41.6
	Total	174	100

Source: Survey data, 2025.

Among those sample respondents more than half (79.31 %) of them are males. It is important because males are more indispensable than females concerning road infrastructure related activities and mobility. Besides this, out of the total respondents about 51.6 % of sample respondents are under adult age group of (31-50 years), this is also contributing to the accuracy of information gathered from such respondents. Furthermore, with respect to educational level, greater number of respondents (98.73%) has an educational level of more than grade 9. This educational characteristic of sample households also helps to get matured, briefly and intellectual perceptions.

Table 4.1 also illustrates the occupations of the respondents, where 34.4% of the respondents are business owners and 30.5% of the respondents are government employers and 33.8% are others. The life span of the respondents in the city shows most of them were living for more than 19 years, which is crucial to investigate a detail and long term impacts of the urban expansion trends.

4.4. Demographic Data of Interviewed Sample

As shown in the table below, the interviewed respondents include public officials such as political leaders, managers, and professional experts, as well as community elders from the city. The insights

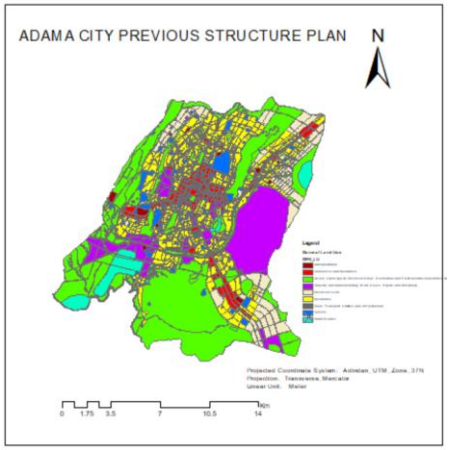
gathered from these participants enabled the researcher to analyze the issue under study both logically and scientifically. Of the total respondents, **40%** were from government offices, while **60%** were community elders. This composition was intentionally selected, as political leaders, managers, and experts provide valuable, practical, and policy-related perspectives, while community elders offer in-depth, experience-based knowledge and insights reflecting the lived realities of Adama City particularly Lugo Sub-City across time. This diverse representation ensures a balanced understanding of the study area (see Appendix 6).

4.5. Analysis

4.5.1 Trends of Urban Expansion

Adama City, Lugo Sub-city shows a dramatic expansion through the period of 2008 to 2018G.C, its trend was depicted on Map 4.1, Map 2 and Map 3 and table 4.2. From 2008 to 2018 G.C urban area expanded rapidly, with **22,517.39ha.** The spatial change in these years was resulted due to rapid population growth and economic growth, and the greater interest of population to invest additional house and expansion of social services are the dominant factors that have brought in urban expansion in the Sub-City.

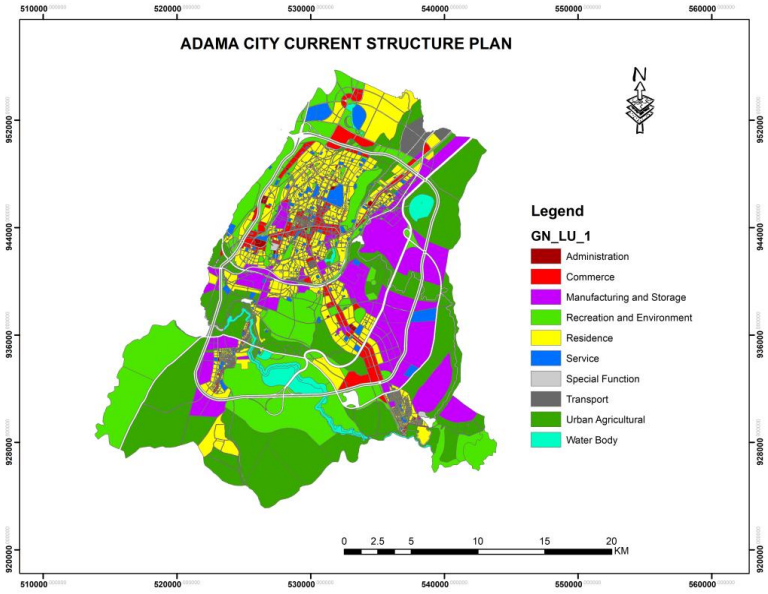
Figure 5: Previous Land Use Plan of Adama City between 2008-2018 G.C



Source: Analyzed Using GIS from Adama Geodatabase by the researcher, 2025.

Map 4.1 indicates that the existing land use categories of Adama City. The areal coverage of the city was **22,517.39 hectares** with different land use classes. From these the highest portion, **29.96% (4,041.85ha)** was covered by settlement of land use classes, next to this **12.5% (2,814.67ha)** was shared by road network (principal arterial, sub arterial, collector and local road) and transport services.

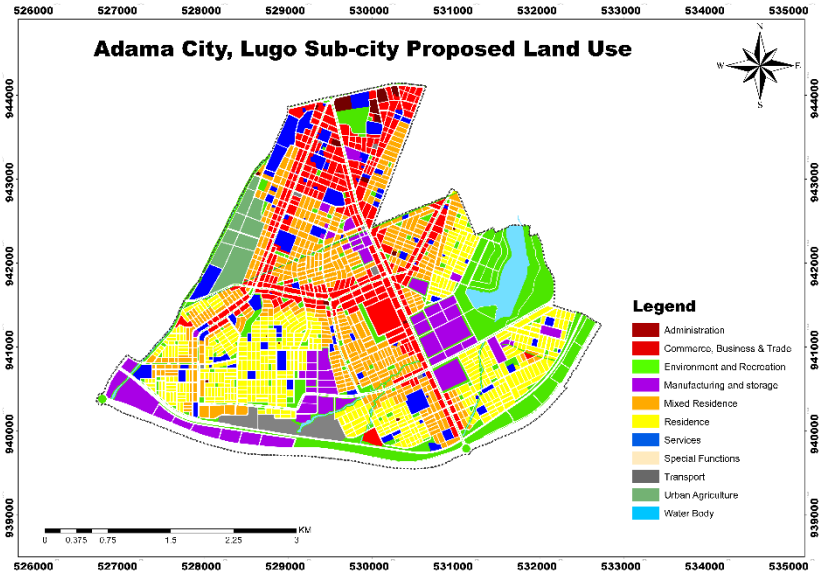
Figure 6: The current Structure Plan of ADama City between 2018-2025 G.C



Source: Analyzed Using GIS from Adama Geodatabase by the researcher, 2025

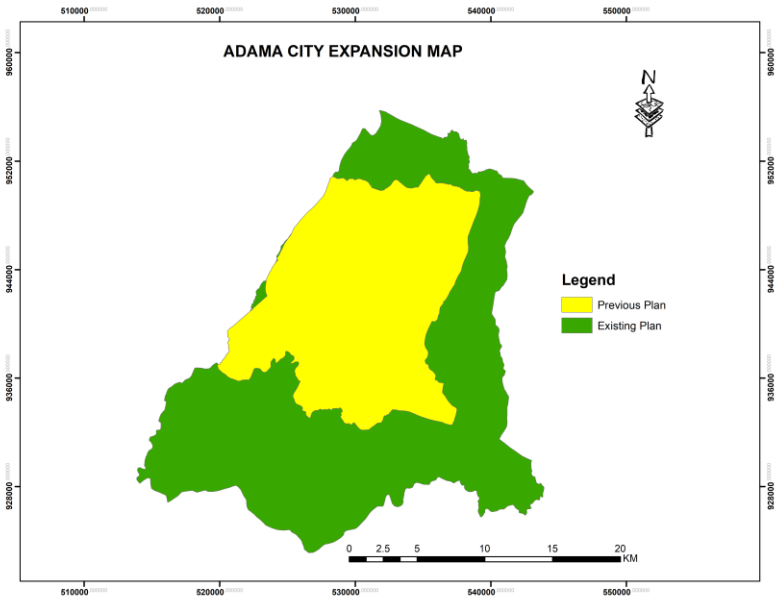
Map 4.2 indicates that the existing land use categories of Adama City. The areal coverage of the city is **54,299.4ha** with different land use classes. From these the highest portion, **24.1% (13,086.15ha)** is covered by housing types of land use classes, next to this **10.5% (5,701.43ha)** is being shared by road network (principal arterial, sub arterial and major collector, minor collector and local road) and transport services.

Figure 7: Lugo Sub-city 2025 Land Use Map



Source: Analyzed Using GIS from Adama Geodatabase by the researcher, 2025

Figure 8: Trends of Urban Expansion (Adama City) Map



Source: Analyzed Using GIS from Adama Geodatabase by the researcher, 2025

Table 4: Land Use change trend of Adama City from 2018-2025

SN	Land Use Category	2018/19		2024/25	
		Area in Ha	Percentage	Area in Ha	Percentage
1	Administration	177.56	0.79	183.00	0.05
2	Residence	4.041.85	17.94	13,086.15	24.09
3	Commerce, Business and trade	1,029.88	4.57	4,606.76	8.48
4	Special Functions	144.84	0.64	756.54	1.59
5	Manufacturing and storage	3,893.77	17.29	6,199.22	11.45
6	Environment and Recreation	3,612.30	16.04	4,860.40	8.98
7	**Road, Transport and associate infrastructure**	2,814.67	12.49	5,701.43	10.49
8	Services	844.95	3.75	1,799.20	3.31
9	Urban agriculture	9,400.58	41.75	15,153.90	27.97
10	Water Body	593.95	2.64	1,952.80	3.59
	Total Area	22,517.391	100	54,299.40	100

Source: Analyzed Using GIS from Adama Geodatabase by the researcher, 2025

According to the existing land use plan of Adama City is going through a remarkable change during the period of 2018-2025 G.C, because, of urbanization and the new Region-polis city establishment. Although all land uses changed ten significance land use classes (Administration, Residence, commercial, services, manufacturing and storage, road network and transportation, environmental and recreation, Urban agriculture, Water body and special function) have rapidly and actively changed, the road infrastructure provision is still insufficient and in poor conditions.

4.5.2. Existing Conditions of Urban Road Infrastructure

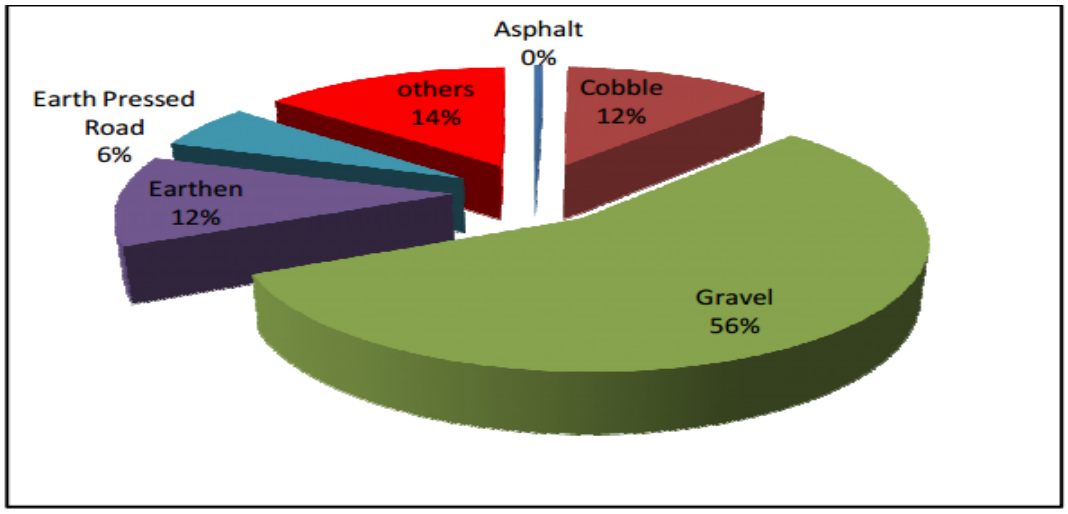
The 2024/25 structure plan analysis revealed that road coverage in Adama city is only **10.49%** of the total land use, which falls below both international standards **(15–25%)** and the Ethiopian urban planning strategy, which recommends allocating **30%** of urban areas to roads, transport, and utilities. This indicates a significant shortfall in road infrastructure.

To address this gap, new roads should be developed in areas lacking connectivity and access. Furthermore, existing roads that are constrained by width or condition should be upgraded wherever feasible, taking into account the city's topography and existing developments.

The study also found that there are no alternative routes available within the city, further highlighting the need for an improved and expanded road network.

Table 5: Road length in ADama City by construction type in 2018

Road type	Asphalt	Cobble	Gravel	Earth	Earth Pressed Road	others	Total
Municipal road (km)	2.9	81.52	382.53	79.7	39.55	96.8	683
%	0.4	11.9	56.0	11.7	5.8	14.2	100.0
Total road (km)	35.8	81.52	382.53	79.7	39.55	96.8	715.9
%	5	11.4	53.4	11.1	5.5	13.5	100



Source: Infrastructure Asset Management Plan of Adama City, 2025

The cobble stone road construction trend of the city has found to be promising despite much has left. In general, about 15.96% of roads (asphalt and cobble stone) are hosting more than 95% of daily traffic. In the past structure plan study of Adama city, there was a road that was proposed as expressway linking Western to eastern area of the city in which currently partially Asphalt 0% Cobble 12% Gravel56% Earthen12% Earth Pressed Road6% others14% implemented (ongoing). Thus, the city has principal arteries, sub arteries, major and minor collector streets and local access roads with a varying width of ROW, carriage way and surface materials.

Table 6: The existing situation of Road Infrastructure by the respondents

Existing Condition		***Status of Existing Condition***					
		Very poor	***Poor***	***Fair***	***Good***	***V. Good***	***Total***
Asphalt Road	Frequency	74	49	24	19	8	174
	Percent	42.5	28.1	13.5	10.9	4.59	96.1
Cobblestone Road	Frequency	29	33	26	61	25	174
	Percent	16.66	18.96	14.94	35.05	14.36	96.1
Gravel	Frequency	90	64	13	10	2	174
	Percent	52.63	36.78	7.47	5.74	1.14	96.1
Earthen	Frequency	72	46	37	14	5	174
	Percent	41.37	26.43	21.26	8.04	2.87	96.1
Drainage	Frequency	77	47	27	17	8	174
	Percent	44.25	27.01	15.51	9.77	4.59	96.1

Pedestrian line	Frequency	75	56	15	14	8	174
	Percent	43.1	32.18	8.62	8.04	4.59	96.1
Street light	Frequency	74	49	24	19	8	174
	Percent	42.5	28.16	13.79	10.91	4.59	96.1

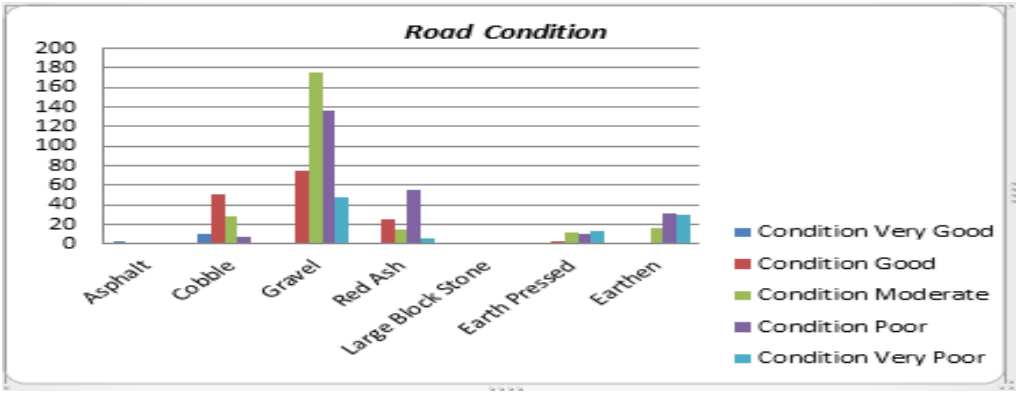
Source: - A household Survey, March 2025.

Table 4.4 indicates that 44.8% of the respondents response shows that the existing conditions of roads in Adama City is found in a very poor condition, On the other hands 47.86% of the respondents revealed that the existing conditions of pedestrians were very poor.

Table 7: Existing condition of road infrastructure for field observation

S.N	Feature Class (Road Surface by Material)	Total (KM)	Condition Indicators				
			Very Good (KM)	Good (KM)	Moderate (KM)	Poor (KM)	Very Poor (KM)
1	Asphalt	2.96	2.13	0.25	0.44	0.14	0
2	Cobble Stone	131.67	67.98	16.68	20.31	24.32	2.38
3	Gravel	537.78	17.60	35.04	270.05	199.18	15.90
4	Red Ash	102.05	5.96	9.88	47.20	35.54	3.48
5	Large Block stone	2.36	0.27	0.21	0.52	1.10	0.26
6	Earth Pressed	39.61	0.00	0.54	19.78	16.35	2.94
7	Earthen	79.71	0.42	3.14	41.11	30.53	4.57
	Total	896.14	**94.36**	**65.74**	**399.41**	**307.16**	**29.53**

Source: Adama City Administration, March 2025



As shown the table 7 Condition Assessment had been done using the revised Asset Management

Operational manual of Ministry of Urban Development and Housing (MUDH) five level condition indicators and deterioration type of each segment and area were captured. Accordingly, the inventory result revealed that from the total **131.67** kilo meter Cobble road of Adama city, about **16.68** and **20.31** km were in Good and Moderate condition respectively while from the total **537.78** kilometer Gravel road, about **270.05** and **199.18** were in Moderate and Poor condition respectively.

4.5.2.1. The Pedestrian Walkway condition of Adama City Lugo Sub-city

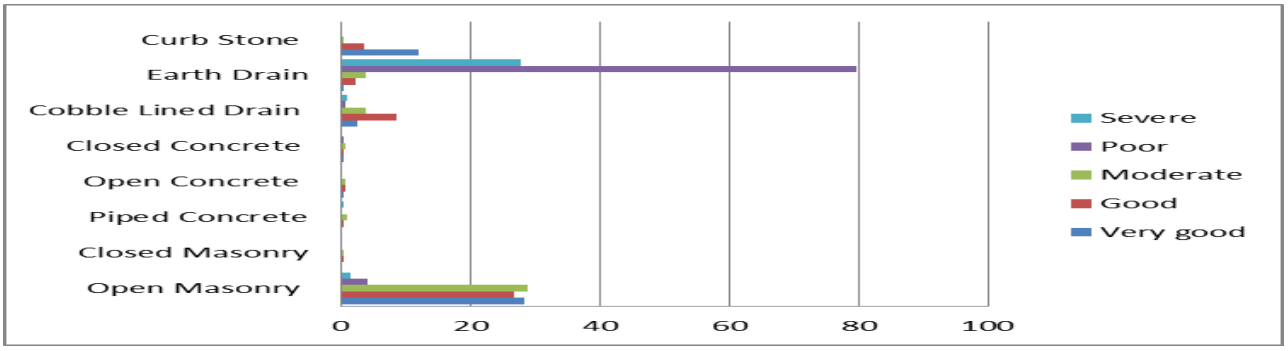
The field survey conducted on revealed that, there was a total of **11.44** kilometer (with equivalent **3m** width) length of Lugo sub-city pedestrian walkway and about **11.44** kilo meter belongs to Adama City Administration and **0 km** belongs to Ethiopian Road Authority. Moreover, the Pedestrian Walkway can be further described in terms of surface cover and the result revealed that the majority **9.88** kilometer **(86.36%)** surfaced with cobblestone followed by Asphalt, which accounts **1.56** kilometer **(13.64 %).**

	Unit	**Quantity**
Pedestrian walkway	Km.(3m eq)	**11.44**

Table 8: Drainage Structure in Adama City

S/N	**Feature Class (Drainage Category)**	**Total Length (KM)**		**Condition Indicator**			
			Very Good (KM)	**Good (KM)**	**Moderate (KM)**	**Poor (KM)**	**Very Poor (KM)**
1	Piped Concrete Drain	1.32	0.28	0.04	0.37	0.63	0.00
2	Closed Concrete	0.98	0.00	0.23	0.07	0.68	0.00
3	Closed Masonry Lined Drain	0.29	0.00	0.05	0.05	0.19	0.00
4	Open Concrete	1.02	0.36	0.00	0.07	0.59	0.00
5	Open Masonry Drain	108.87	13.66	3.20	16.34	68.18	7.49
6	Earth Drain	113.65	0.82	5.16	25.18	76.47	6.01
7	Cobble Lined Drain	20.62	8.93	0.08	2.10	9.36	0.15
8	Curb Stone Drain	18.71	5.60	0.00	3.45	7.04	2.61
	Total	**265.46**	**29.65**	**8.76**	**47.63**	**163.14**	**16.26**

Source: Field Survey, 2025 and Adama Municipal office document



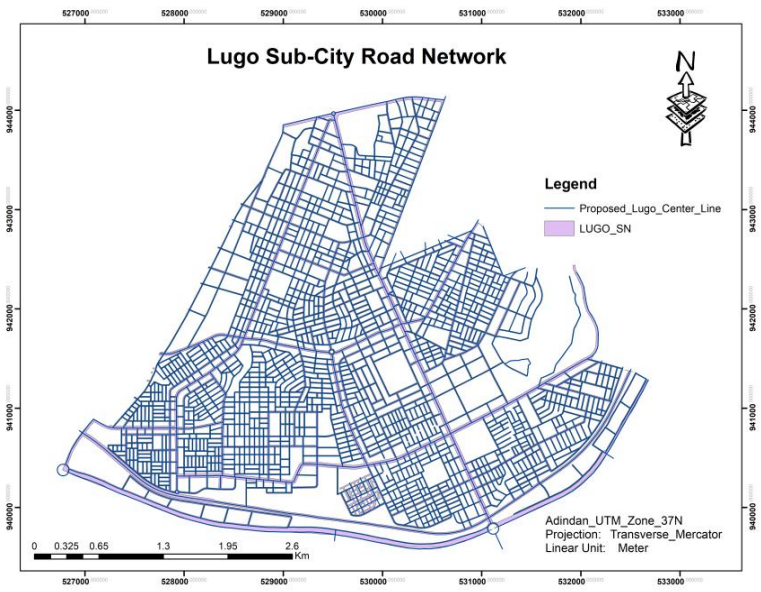
Source: Field Survey, 2025

Table 8 shows that only a small portion of roads in the study area are equipped with side drainage ditches. Out of 896.14 km of roads in Adama City, only 265.45 km have drains, resulting in an average of just 0.29 km of drainage per kilometer of road.

According to interviews with the Adama Town Road Authority and the City Administration, the municipality owns a range of fixed assets essential for road infrastructure development, including graders, bulldozers, loaders, compactors/rollers, and surveying instruments. These resources enable the city to carry out road construction and maintenance activities using its own equipment.

4.5.2.2 Road Hierarchy of Adama City

Figure 9: 2018-2025 G.C Lugo Sub-city Road network



Source: Analyzed Using GIS from Adama Geodatabase by the researcher, 2025.

The above map 4.3 depicts that the road hierarchy system of Adama City. It consists of four hierarchies

of roads such as Arterial and Sub arterial, Collector roads and local road hierarchical types. Which cover the total area coverage of **5,701.43ha** of the total areal coverage of the city, of which 73.94 ha is covered by collector road and ha by local road, 18.2 ha covered by an arterial road and 7.86 ha is covered by sub arterial road hierarchical type. Out of these Lugo sub-city has

Table 9: Length, width and area of road networks

Road hierarchy	Width (meter)	Length (KM)	Percent
Primary Arterial	30-50	82.3	9.77
Sub arterial	20-25	161.04	19.12
Collector	15-20	265.85	31.56
Local	8-10	333.12	39.55
Total		**842.31**	**100**

Source: *Adama City Administration, 2024.*

4.5.2.3 Types of Road in Adama City

There are many types of road infrastructures exist in the world, all of which form a route between different places that can be used by different road users. Also in Adama City there are different types of road infrastructure, it can be described as follows in Figure 4.1 as follows;

Table 10: Length of road by surface types in Adama City

S/N	Road Surface	Primary Road (KM)	Secondary Road (KM)	Collectors and Local Road (KM)	Actual total length/km	Coverage %
1	Asphalt	62.3	30.5	18.37	111.17	13.19
2	Cobble Stone	0	0	128.64	128.64	15.27
3	Gravel	0	0	394.34	394.34	46.84
4	Red Ash	0	0	89.02	89.02	10.56
5	Large Block stone	0	0	3.06	3.06	0.36
6	Earth Pressed	0	0	39.83	39.83	4.73
7	Earthen	0	0	76.25	76.25	9.05
	Total	**62.3**	**30.5**	**749.51**	**842.31**	**100**

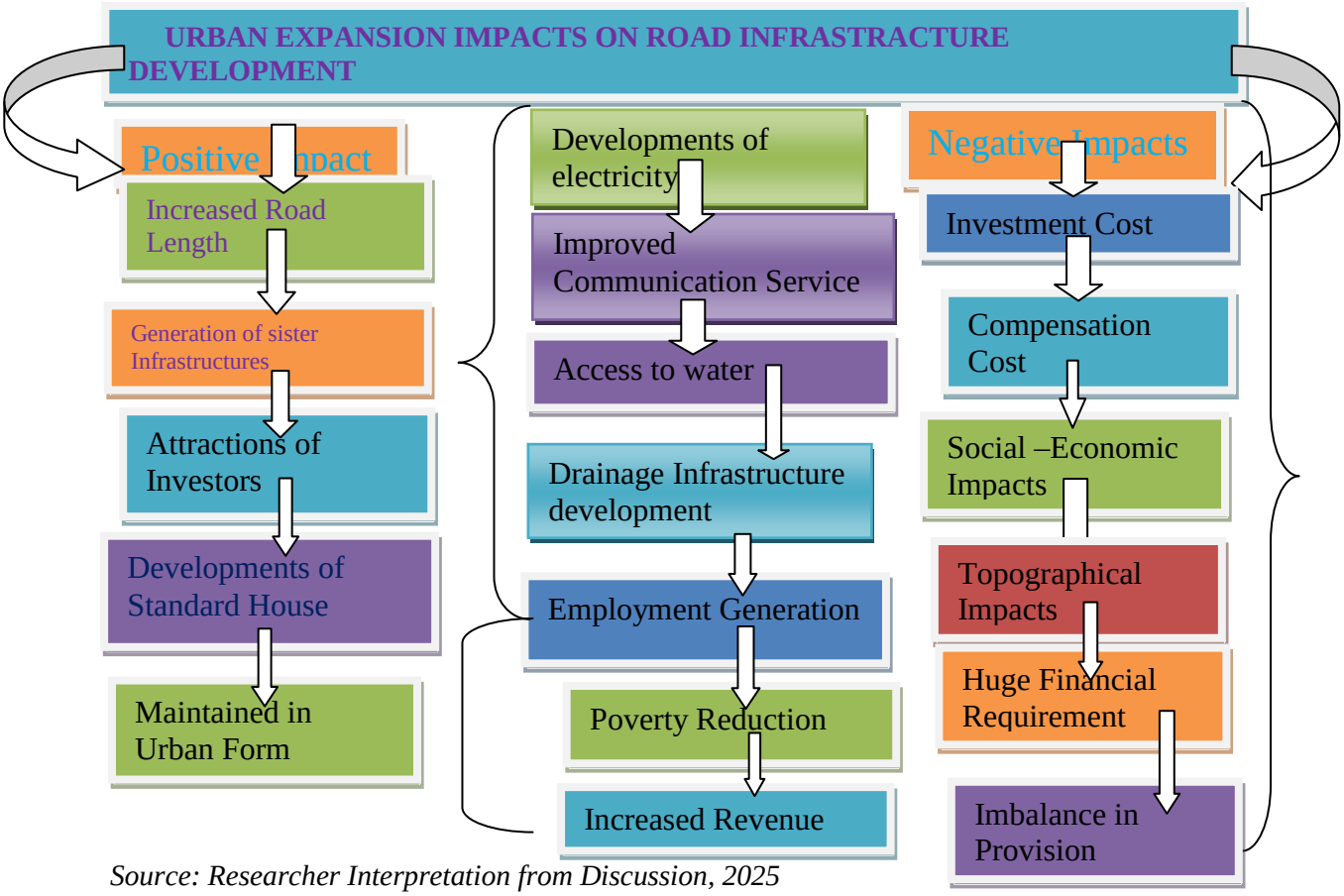
Source: Field Observation plus Municipal Document review, 2025

The above figure shows that the types of road infrastructure based on the surface types. The classification is asphalt, Cobblestone, gravel and earthen, Red Ash, large block stone, earth pressed road in the city, which constitutes 111.17km, 128.64km and 394.34km, 89.02km, 3.06km, 39.83km,76.25km respectively.

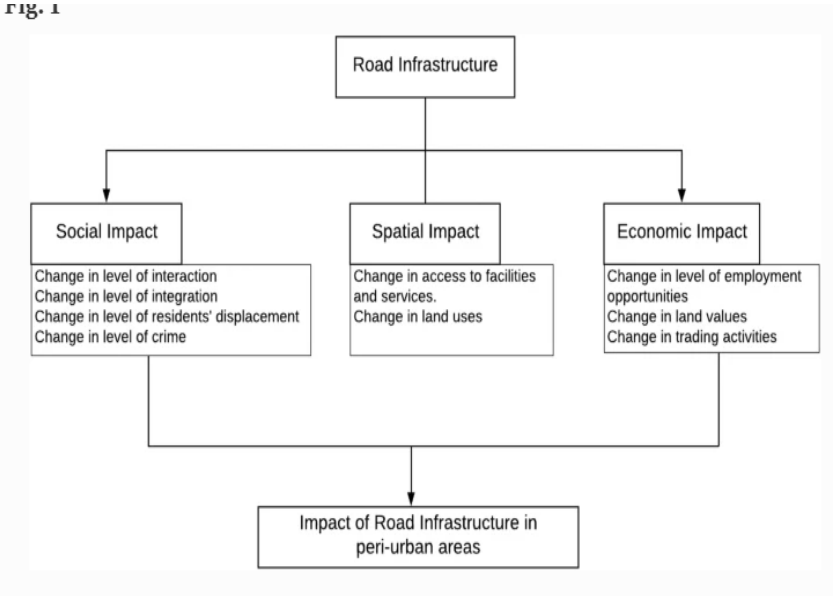
4.6. The Impacts of Urban Expansion

Urban expansion may involve both horizontal and vertical types of the expansion. The vertical type of urban expansion is a modern and land/space saving urbanization in which building of Urbanization and urban growth are considered as a modern way of life and the centers of the varieties of human opportunities which all can highly contribute to Socio-economic growth and development. However, as Shlome A. et al (sited in Tegegne, 2008) argues, horizontal expansion of urban areas in Ethiopia causes a number of socio-economic problems including mobility, flooding and dislocation. From these scholar findings, we can generalize that, while well planned and managed urban expansion may enhance the common benefits of stakeholders; otherwise, the process leads to high negative externalities particularly to the municipality and residents. So in general urban expansions have a positive impact and negative impacts. From scholars finding, the researchers have generalized the impacts of urban expansion on road infrastructure development in the following figure.

Figure 10: The impacts of urban expansion on road infrastructure development



Source: Researcher Interpretation from Discussion, 2025



Source: Researcher Interpretation from Discussion, 2025

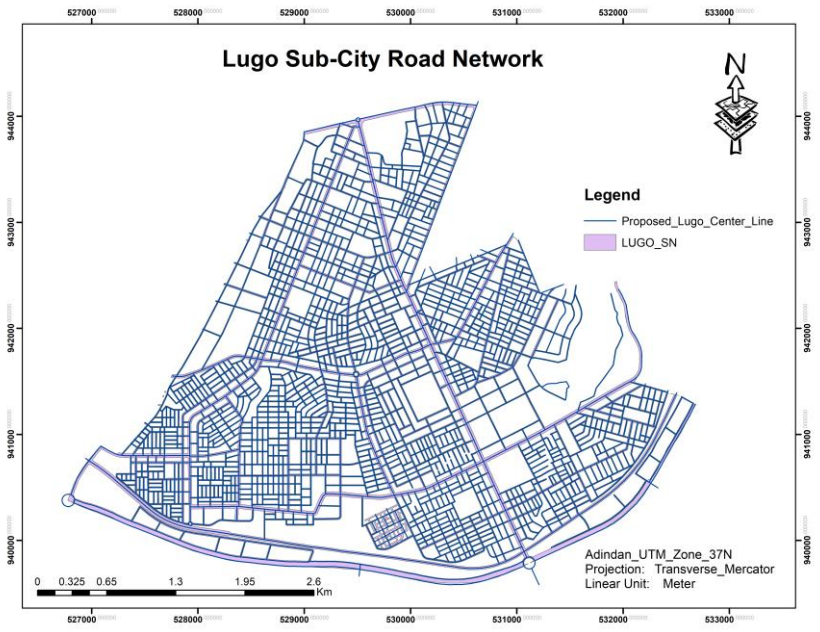
4.6.1. Positive impacts of Urban Expansion

According to Fleming, .K. and Hayuth, Y. (1994), the expansion of urban physical extends of cities affects road infrastructure which is the physical features of urban areas, the dominance of economic expansion extends to recall all the growth and developments that helps the public economy to improve such as creating jobs, attraction of investors and shipping urban forms.

A. Road Transport Infrastructure Expansion

The study revealed that urban expansion has brought road infrastructure expansion.

Figure 11: The addition of road length from year 2018-2025



Source: Analyzed Using GIS from Adama Geodatabase by the researcher, 2025.

The above figure 11 depicts that urban expansion has brought an increase in the road network, this is the results of an agglomeration of different factors, these are the demand for mobility, utility infrastructure (sister infrastructure) and also the expansion of social services in the city, have increased the development for road networks in the Adama City.

B. Maintaining Urban Form

The term "urban form" is used to describe a city's physical characteristics. It refers to the size, shape, and configuration of an urban area or its parts. How it will be understood, structured or analyzed depends on scale. Characteristics of the urban form range from at a much-localized scale, features such as building materials, facades and fenestration to at a broader scale, housing type, street type, and their spatial arrangement or layout.

According to the CSA (2007) report, the population increased significantly from **127,842** in 1994 to **456,900** in 2022. This sharp rise is primarily attributed to the rate of urbanization. As a result, the rapid population growth has placed considerable strain on the development and capacity of existing infrastructure.

The term 'urban form' can be used simply to describe a city's physical characteristics. At the broad city or regional scale, urban form has been defined as the spatial configuration of fixed elements (Anderson et al., 1996). Features of urban form at this scale would include urban settlement type, such as a market town, central business district or suburbs. However, urban form is closely related to scale and has been described as the 'morphological attributes of an urban area at all scales' (Williams et al., 2000). Characteristics therefore range from, at a much localized scale, features such as building materials, facades and fenestration, to, at a broader scale, housing type, street type and their spatial arrangement, or layout. It should be noted that urban form does not simply relate to physical features, but also encompasses non-physical aspects. One can see this in the example of density. Simply put, density is used as a measure of the number of people living in a given area: it is not just a physical, tangible element. Density is also closely linked with the configuration of the social environment and interaction within residential neighborhoods: flats and apartments are examples of high-density housing whereas detached and semi-detached properties tend to be of lower densities. There are therefore non-physical economic, social and political processes in place which are physically manifested in housing, schools, parks and other services and facilities. The scales at which urban form can be considered or measured include the individual building, street, urban block, neighborhood and city. These levels of spatial dis aggregation influence how urban form is measured, analyzed and ultimately understood. The issue of

scale is discussed throughout this chapter (and the book) as it constitutes an underlying dimension of any examination of urban form.

Urban form generally encompasses a number of physical features and nonphysical characteristics including size, shape, scale, density, land uses, building types, urban block layout and distribution of green space. These are categorized here as five broad and inter-related elements that make up urban form in a given city.

4.6.2. Negative impacts of Urban Expansion

Urban expansion has negative impacts. In the following section the researcher is examine four main issues related to urban expansion impacts. The first issue is the negative effect of urban expansion on investment cost. The second impacts are on compensation costs. The third impacts are the social impacts and the fourth is topographical impacts.

A. The impacts of Urban Expansion on Road Investment Cost

During the 2008 to 2018 the road network and transportation services had taken place on the road length of **124.81km**, but during the expansion period (2018-2025 G.C). It was increased to **842.31km** from the total area coverage of the city. Therefore, the costs of investments or construction for different road that need to be built in the Adama were estimated according to the current cost.

Table 11: The types of road and their current estimated cost

No	Types of Road	Length in KM	Cost per Km
1	Asphalt Road	3.2	506,205,740.28
2	Cobble stone	17.2	96,608,502.32
3	Gravel	52.4	333,422,310.84
4	Earthen road	-	-

Source: Adama City Administration, 2024

Table 4.9 indicates that urban expansion has brought the addition of **91.8 km** of road length; in addition to this, it shows that the cost of investments for different road types per kilometer, the current cost of investment in asphalt road is **506,205,740.28**, the cost of cobblestone is **96,608,502.32** and the cost of gravel road is **33,422,310.84** Birr respectively.

B. The Impacts of Urban Expansion on Compensation Cost

Communities owe much of their vitality to the ease with which economic and social interactions take place. Ironically, while roads are central to this continuing interaction, the introduction of a new road, or the widening of an existing road, may well cause disruptions to local interactions Mary. et al, (n.d). According to FAO (2008), recent road-widening policies that are taken in many developing countries have failed owing to their economic (huge money is required to compensate the roadside house owners) and political constraints. Field observation results showed that in Adama City, mostly dominance of

dilapidated houses was observed, which are built in an unplanned manner, this is resulted due to the previous master plan does not visualize the future road infrastructure demand and did not plan in widening the road. This required the acquisitions of land to widening and paving of road network, this in turn have required a huge compensation costs.

Table 12: The estimated cost of compensation

Number houses and Fences in the state of demolishing	Average Estimated Cost in million	Total cost required to compensate
274	1,640,000	449,360,000

Source: Adama City Administration, 2025

The above Table 12 indicates that the houses to be displaced due to the improvement of the road width taken from Barecha, around Sub City administration and Migra woreda.

C. The Socio-Economic Impacts of Urban Expansion

Rodrigue, J (2008), Urban expansion causes displacement, dislocation and segregation that result in social fabrics disorder. People in the extended urban areas "live still partly rural and where many of the residents live in the country, but are not socially and economically on it". They usually do not participate in the planning and design of resettlement and dislocation options as well as the distribution of associated costs or benefits. Since social infrastructure is concentrated in, the central people in the extended area rely on proximity to facilities

a. Accessibility of the Residents from House to different Places

Table 13: Distances travel to different activities

Distance in Km	Distances from home to different areas					
	From home to social service		To work place		To shopping center	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
0.5km-1km	32	20.7	22	14.3	32	20.7
1.1km-1.5km	32	20.7	31	20.1	34	22.0
1.6km-2.6km	39	25.3	42	27.2	38	24.6
>2.7km	51	33.1	59	38.3	50	32.5

Source: House Hold Survey, 2025

The survey and field observation results revealed that, the residents are travelling the distance between 1.6 km to 2.6km from their home to social service (25.3%), Work place (27.2%) and shopping center (24.6%) of them. With other hand, 33.3%, 38.3% and 32.5% are travelling the distance above 2.7 km from their home to social service, workplace and shopping center respectively as the household

responds and interview responses.

b. The Economic Impacts

Table 14: Economic Impacts

Response	Frequency	Percentage
High cost for new house construction	12	24
Loss in customer	16	32
Reduction in profit making	19	38
Change in business types	3	6
Total	50	100

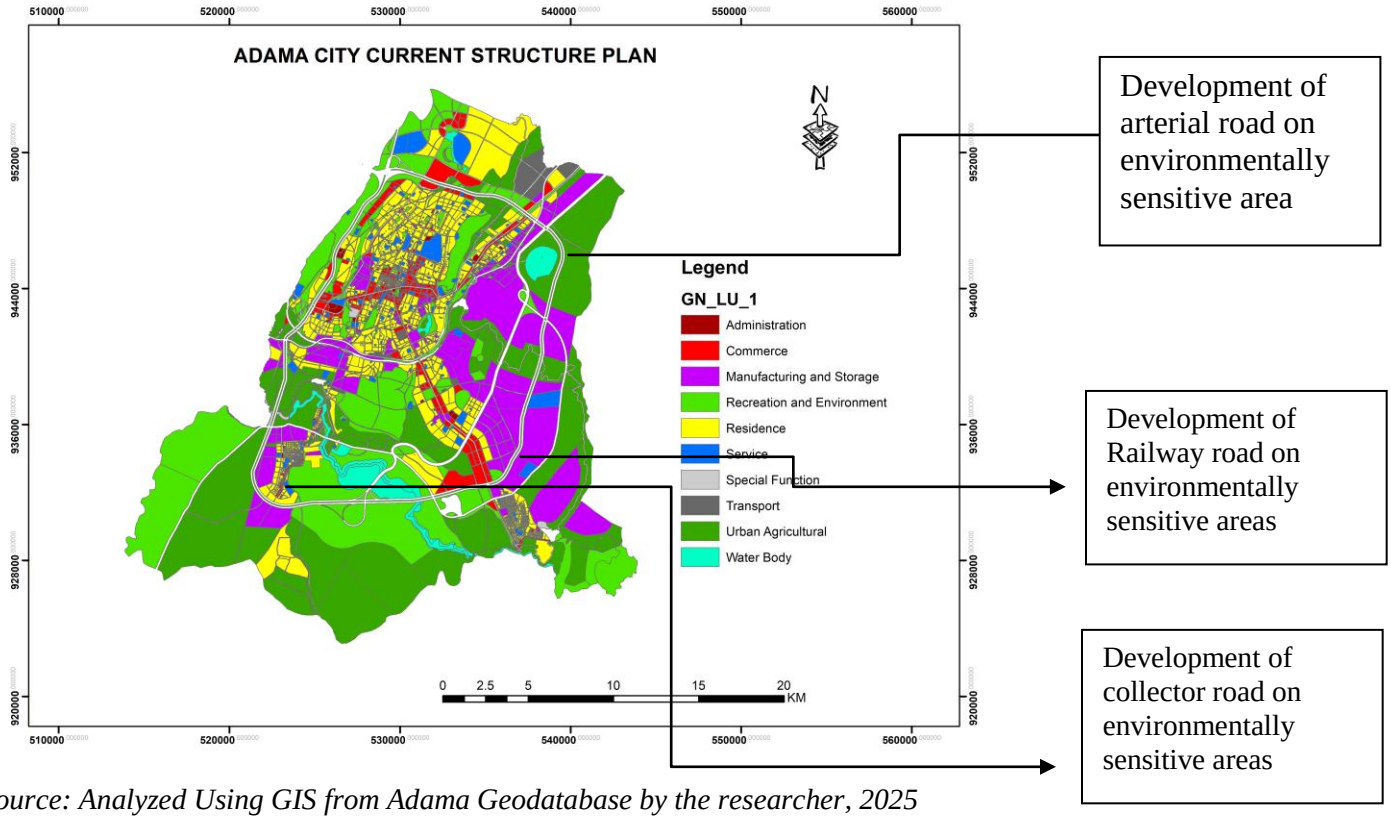
Source: Field Survey, 2025

Table 14 depicts that reduction in profit making was shared the greatest percentage (38%, followed by failure to sustain with the customers, (32%), 24% the cost requirement to build new house and 6% changing the previous types. The increments in road width and length have great impacts on the business owners of Adama City.

D. The Impacts of Urban Expansion on Topography

Urban expansion increases the demand toward road infrastructure development; but it is determined by different factors, among these topography is the one which increases the cost of investment in its development, the up and down of the features, marsh are the main factors in the development of road infrastructure, it can be a decisive when determining what types of land use can be accommodated. In this case slope and drainage can be seen a major aspects of determining the topography in the provision of road infrastructure development.

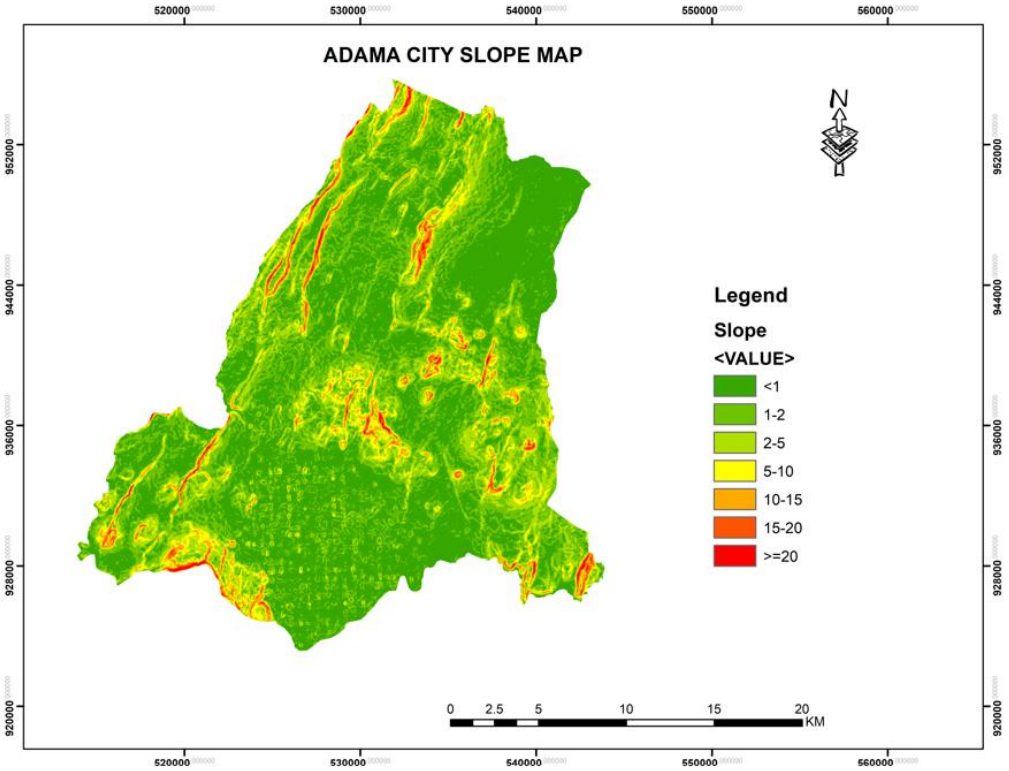
Figure 12: Roads arterial and Collector Street on environmental sensitive



Source: Analyzed Using GIS from Adama Geodatabase by the researcher, 2025

The above map 4.6 indicates the developments of road infrastructure on environmentally sensitive areas; the current master plan does not consider the physical and geographical setting of the City. It also depicts that the current road network hierarchies like arterial and collector road are proposed in environmentally sensitive areas, the expansion area has unsuitable physical terrains such as rugged terrains, marshes, wetlands and the quarry site, and this was requiring a huge investment cost. In addition to that, the Man-made fetcher is like the Djibouti railway also the topographic impact environmentally sensitive area in Adama City road infrastructure provision. As the interview made with the municipality construction department engineer stated that, in Adama City topography is highly affecting the provision level of road infrastructure in the city.

Figure 13: Adama city slop map for infrastructure development



Source: Analyzed Using GIS from Adama Geodatabase by the researcher, 2022

The slope map of Adama city indicates that the most floodable part of the city has slope category below 1%. This slope class covers most parts of southeastern parts of the city (1434.8 hectares or 8.2%) especially in area around Wonji Mazoria. This is the most floodable area of Adama city and hence its watershed should be properly managed before the onset of the rainy season.

The steepest part of Adama city with slope category over 20% is found on the western uplands, Northern, Northeastern, and Northwestern and in pocket areas of Boku Shanan Sub-city uplands of Adama city. This steepest gradient over 20% is source of flood because of downhill rushing down of flood during the rainy season. Because of this, the steepest gradient over the uplands should be proposed for protected forest to increase the infiltration rate of floodwater thereby decreasing down ward flood. As it is shown on the map above, the dominant slope category of the city is between 1-2% and covers about **20,462.85** hectares. The second dominant slope category is between 2-5%, which covers about **18,317.73** hectares, the slope category with the high cost of road infrastructure development are 0-1% and >15% and covers about **188.35** and **111.3** hectares and found in different parts of the city as shown on map 4.7 above., these areas are characterized by high elevation, swampy, query site and gorges, that requires high cost of road infrastructure development.

4.7. Interpretation and Discussion

4.7.1. Urban Expansion Trends of Adama City

According to Shlome et al. (2005), the pattern of urban expansion is closely linked to shifts in both the economic and demographic conditions of a given area. This has led to development trends such as leapfrog growth, irregular land subdivisions, and scattered settlement patterns, all of which have contributed to the poor quality of infrastructure, particularly road networks. Significant urban expansion in Adama City has been observed between 2018 and 2025 G.C., largely driven by land distribution and the establishment of new region-polis cities. Key areas affected by this transformation include Bole, Ganda Hara, the vicinity of Adama University and Adama Korkoro, as well as Asella Mewcha, which have undergone rapid urbanization.

However, this expansion has not been matched by proportional development in road infrastructure. The growth has primarily been horizontal, with little regard for current and future demands for transportation networks. As a result, infrastructure provision has lagged significantly behind urban growth. Survey responses from Adama City residents show that 83% of the 161 households surveyed and 92% of the 11 key informants interviewed believe the expansion of the road network has not kept pace with the city's land use changes, resulting in inefficiencies in urban function.

Moreover, the current land use plan lacks sufficient road infrastructure and street furniture, as illustrated in GIS-based Map 4.2. Supporting this view, MoFED (2012) noted that while Ethiopia’s road network is relatively extensive, it suffers from poor maintenance and a fragmented administrative framework. This research aligns with the findings of both Shlome et al. (2005) and MoFED (2012), indicating that Adama City's rapid expansion has not been supported by adequate road infrastructure in terms of both quality and quantity. Overall, the development of road infrastructure remains insufficient relative to the pace and scale of urban growth.

4.7.2. Overview of the Existing Urban Road Infrastructure

According to Wexenius (2006), road and spatial structure has a strong influence on the spatial structure at local, regional and global level. However the findings in page 31 table (4.3 and table 4.4), indicated that 44.8% of the respondents replied that, the existing condition of asphalt road is very poor, and 28.1of the respondents replied that it is poor. And also the existing condition of cobble stone of Road 15.58% of the respondent replied very poor and 18.18% of the respondent is replied poor, On the other hand (53.4%) of

the respondents replied that the existing condition of gravel pavement is in very poor and 37.1% of the replied are poor condition. In addition to the condition of earthen road 41.5 % of the respondents replied that the road condition is very poor, (27%) of the respondents replied that it is in poor condition. But according to the World Bank (1996), standards state that; the conditions of road infrastructure is good whenever paved roads substantially free of defects and requiring only routine maintenances or unpaved roads needing only routine grading and spot repairs, a road conditions also a road is fair whenever paved roads having significant defects and requiring surfacing or strengthen or needing reshaping or restructuring and having spot repaired or drainage,

In addition to this a road is also poor when paved roads with extensive defects and refusing immediate rehabilitation, or whenever road need reconstruction and major drainage works.

Based on this standards table 4.4 and plates 4.1, plate 4.2 and plate 4.3 depicted that; from the total of 3.2km of asphalt road1.3km showed that severely deteriorated that required a huge operation and maintenance costs, similarly from the total of 26 km of gravel road type indicated that almost the total (19.4 km) of which is severely deteriorated. Beside this from the total of 44.97 km of earthen road the greatest share (27.56km) road is in severely deteriorated. In general 48.26km of road length from the total of 78.97km of road length of the City was severely deteriorated, so the condition road infrastructure in Adama City is poor.

4.7.2.1. Road Hierarchy of Adama City

According to Hiraskar (as cited in Andualem, 2007), urban roads are classified based on their importance into arterial roads, secondary (sub-arterial) roads, local roads, and other types. Similarly, the road hierarchy in Adama City is categorized into arterial, sub-arterial, collector, and local streets. However, the existing streets in the city are generally narrow, limiting accessibility and connectivity. In particular, many sub-arterial roads have widths of only 14 meters, which falls short of the standard width of 20–25 meters.

Gizachew (2012) and field observations conducted by the researcher indicate that most cobblestone roads in the city are not adequate for efficient community mobility. This inadequacy is reflected in survey results, where 78% of respondents reported that the poor condition of cobblestone roads has led to a lack of taxi services. As a result, most residents rely on walking and bajaj (three-wheeled vehicles) for transportation. This reliance creates further challenges, as dust during the dry season and mud during the rainy season significantly hinder movement.

4.7.2.2. Types of Road in Adama City

Tolley (in Moges 2003), earthen road is unimproved road with no surface materials added. They are not usually graded regularly to produce an enhanced chamber to encourage rain water to drain off the road, and drainage ditches at the sites absent. As the field observation during the data collection and document review result shows that 81.52 km and 382.3km from the total of 683 km is covered by Cobblestone and gravel road types, furthermore, the majority of earthen roads are in a very poor conditions, also the cobblestone road are poor, moreover, most of the roads are insufficiently maintained and also many streets are compacted earth, lack proper maintenance and absences of drainage is causing dust in dry season and mud during the rain seasons (Plate 4.1and plate 4.2(see Appendix). As concluded in figure 4.2 only 2.9 km of the road is covered by asphalt road by the municipality and cobblestone road also 81.52km constructed, 382.53km by gravel and 79.7km covered by earthen road infrastructure, as well as earth pressed road also 39.55km the others road type is 96.8 generally the Adama City road is 683 km.

4.7.2.3. Drainage Condition of Adama City

According to Moges (2008), implementing sustainable urban storm water management in developing countries is often hindered by poor urban planning and uncontrolled urban sprawl. Supporting this view, Sidawi and Eichenbaum (1994) emphasized that flooding is one of the most significant natural hazards impacting human society and plays a critical role in shaping both social and economic development. In line with these observations, storm water and flooding have emerged as major challenges in the study area. The primary causes of flooding are the rapid horizontal urban expansion and the inadequate development of road infrastructure.

Interviews conducted with residents revealed that during the summer of 2013, a flash flood tragically claimed the life of a woman who relied on begging for survival in the city. Mohammed and Deepak (2008) also pointed out that flood disaster recovery and reconstruction efforts often replicate the very social vulnerabilities that contributed to the initial disaster, thereby increasing the risk of further harm or fatalities.

Field observations show that flash floods originating from sloped areas have altered land use patterns in parts of the city, especially along collector roads (as illustrated in Plate 3 and Plate 4). Furthermore, data from Table 4.3 indicate that 42% of respondents believe the existing drainage system is in poor condition. The drainage infrastructure in the city is notably insufficient only a small portion of the road network is equipped with side drainage ditches (as shown in Table 4.4). Specifically, there are only

9.04 kilometers of drains (comprising 2.22 km of closed masonry drains, 2.69 km of earthen drains, and 4.73 km of open masonry drains) for a total of 78.97 kilometers of roads, resulting in a drainage density of just 0.122 km per kilometer of road.

According to interviews with officials from the Adama City Road Authority and City Administration, the municipality does possess essential equipment such as graders, bulldozers, loaders, compactors/rollers, and surveying instruments that could support the development and maintenance of road infrastructure and drainage systems. However, the gap between existing needs and infrastructure provision remains a critical issue.

4.7.2.4. The street Light Condition of Adama City

Condition Assessment for Street Light is also very difficult to assess the condition of each street light since it includes physical testing of the light by experienced electrician which beyond the scope of this assignment. Rather the consulting firm did differentiating the street light whether it is functional or not. Accordingly from the total 1,142 street light 365 were functional and 777 were non-functional.

Table 15: Total number of streetlight in Adama City

S/No	Street Light Type	Total Number	Functiona	Non Functional
1	Florescent Lamp	405	57	348
2	High Pressure Sodium (HPS)	599	252	347
3	High Pressure mercury Lamp	138	56	82
	Total	**1142**	365	777

Source: Adama City Administration, 2025

4.8. The Impacts of Urban Expansion

Urban expansion has two took two forms, vertical and horizontal; the former has resulted with positive and negative effects of road infrastructure development. According to Shlome et. al, (2005),the available evidence, although spotty, controversial, and not necessarily applicable to developing country cities suggests that there is a difference in the growth and expansion of cities are associated with both positive and adverse outcomes that affect the welfare and wellbeing of their citizens.

4.8.1. Positive impacts of Urban Expansion

A. Road Transport Infrastructure Expansion

According to Fleming, D.K. and Y. Hayuth (1994), the expansion of urban physical extends of cities affects road infrastructure which is the physical features of urban areas, the dominance of economic expansion extends to recall all the growth and developments that helps the public economy to improve such as creating jobs, attraction of investors and shipping urban forms. Similarly, Adama City is

characterized by rapid urban expansions that have provided positive impacts to the residents.

The study shows that Adama City under shows an increased in road transport expansion from 1996 to 2016 (Map 4.4). Road transport infrastructure increased dramatically from 78.97km to 128.45 km Cox and Utt (2004), argued that a fundamental characteristics of urban expansion is that there are two sets of road infrastructure. The dual cost is one providing new road infrastructure for those moving out ward and the second is maintaining the old road infrastructure for the population and economic entities left behind. The interview with key informants 79% and Adama City Administration as well as field observation results revealed that the addition of 91.8 km of road length have initiated the municipality to pave and upgrade the existing road condition and increased the participation of the community in the city.

B. Generation of Sister Infrastructure

According to Belew.D (2011), the development of urban infrastructure and municipal services is of paramount importance for economic growth and for the improvement of quality of life in cities of the developing countries but the provision level is highly depend on the provision and development road infrastructure, because the road infrastructure is the foundation for the provision of sister infrastructure condition. That means the presence as well as the absence of road infrastructure determines the development and distribution of sister infrastructure. The contemporary urban society needs an efficient system of electric power, water supply, storm water drainage and telecommunication services and facilities (Yirsaw .Z, 2012). In Adama City the addition and operation and maintenance of the existing road network improved the expansion of sister infrastructure of the city. The provision of this sister infrastructure is highly depends on the effective planning and provision of road network.

C. The Development of Electric Power Distribution

Electricity has been seen as an important factor intended for the progress of any given country. It is also an engine of social and economic opportunity in that no country can manage to develop beyond a subsistence economy without having at least minimum access to electrical services for the larger proportion of its population (Steer et al., 2000).The reliability of electrical energy supply has been one of the most important concerns guiding the restructuring of the electric power industry NERC, (2014).

In addition to this MoFED (2012), ensure reliable electricity supply and transmit the electric power efficiently and economically to consumers, construction of a reliable distribution and transmission networks is essential.

***High Tension Lines and* Substation**

The Adama City substation, covering a total area of 5.96 hectares, is situated in the northwestern

direction along the collector road to Galama Abba Gada and Koka. It is also located within the city's southeastern expansion zone, near the peripheral area of Awash Malkasa'a, with road access to both Dagaga Village and Awash Malkasa.

This substation serves as the entry point for high-tension power lines originating from Koka. These lines, which supply electricity to Adama City, operate at a capacity of 230 kV each and are configured with double circuits. Due to their high voltage, a safety clearance of 20 meters must be maintained on both the right and left sides of the transmission lines. These buffer zones should be maintained as green corridors with controlled vegetation, ensuring that tall trees do not grow to heights that could interfere with the lines and pose risks to public safety and property.

In addition, Adama City is also home to a wind farm project, contributing to the region's renewable energy development.

Table 16: Lists of electric clients in Lugo sub-city

Types of functions	Existing clients	Waiting clients
Residential	7669	7560
Commercial	1302	35
Industrial	111	40
Total	**9082**	**7635**

Source: Ethiopian Electric Service Adama District, April 2025

D. Developments of Telephone services

According to MoFED (2012), providing and ensuring information and communication infrastructure with higher quality of information and communication service for every citizen of the country. The access to communication in urban area is one of the indicators of road infrastructure development, because telephone cables cannot be installed where in an area which lack road network, in addition to this the provision of telephone service is highly interrelated with road infrastructure, the development of road infrastructure can be served as an inputs for the development of communication service.

According to ETCCO (2008), the widths and depth of underground cable installation and distribution is highly depends on good road condition because it determines the cost and the sustainability level of the service. For instance the installation of cable on the sub arterial street need a road width of 6-8 meters, on a local between 8-12 meters and on a collector road between 25-30 meters, but previously the road width in Adama City is below this standards which is indicted in section 4.4.1.2 of table 4.2, so

this affected the provision of telephone services at household level in Lugo sub-city.

As interview made with key informants the provision of road infrastructure have improved their communication level, previously they were used tele center as the only communication service center, but currently the improvement in road infrastructure development paved the way for the distribution of telecom service to their vicinity, rather than taking tele center as the only means of communication. In addition to this, as the information obtained from telecommunication Authority of Lugo Sub-City ,they are used the city land use plan as an input to identify the road network route for the preparation of the city communication plan, because the installation pattern is highly governed by the length of road network of the city.

E. Improved water supply

According to Adama city water supply office, Lugo sub-city has been getting water supply from 10 (ten) deep wells (boreholes) and 1 (one) spring. In addition there are about 34 (thirty four) public water points. This is very small when it is compared with the number of population and with the existing industries and services.

From data collected by questionnaire and information from the society, there were water supply shortages in the city. Other than water supply for the society, there were a lot of industries and hotel services in the city which consume more water. Because of this reason, the water consumption and demand has been increasing from time to time.

Table 17: Water production and consumption of the city

Years (E.C)	Water		Lost (m^3)
	Production (m^3)	Consumption (m^3)	
2005	1,799,945	_____	
2006	2,239,492	_____	
2007	2,494,638	1,668,559	826,079
2008	3,135,621	2,026,409	1,109,212
2009	3,522,993	2,015,315	1,507,678
Annual av.	3,051,084	1,903,428	
Daily av.	8,475	5,287	3,188

Source: From Adama city water supply office

The water supply system of Adama city mainly comprises production of water at the source.

Table 18: Summary Table of water supply network

S.No	Water Supply Category	Unit of Measurement	Quantity
1.	Water Supply Distribution Line	Km	130.39
2.	Water Supply Transmission Line	KM	40.18
3.	Well	Number	22
4.	Bore hole Pumps	Number	24
5.	Collection Chambers	Number	3
6.	Valve Chambers	Number	46
7.	Booster Pumps	Number	16
8.	Reservoir	Number	12
9.	Water point	Number	74
10.	Hydrants	Number	4
11.	Chlorination Plant	Number	1
12.	Spring	Number	1

Source: From Adama city water supply office

Transmission of water to distribution centers and distribution of water to customers. The major assets being used for provision of the water supply service includes water production and treatment plant, water lines, reservoir, pumps, valves, chambers, water wells(boreholes), public water taps, water meters and joints. The tabular database developed for capturing the spatial location and attributes of water supply network asset of Adama city are presented as follows.

The Water Supply Network Asset inventory of Adama City revealed that the city has 130.39 km distribution pipe network and 40.18 km long transmission pipeline. In addition, the Water Supply Office of Adama city has a point location asset, which include Reservoir (12), Valve Chambers (46), Collection Chambers (3), Boreholes (22), Booster Pumps (16), and Borehole Pumps (24), Public Tap (74), Hydrant (4), Chlorination Plant (1) and spring (1). According to data collected based on questionnaire from Adama City water supply bureau, there is shift daily and from 3 days to 15 days to get water.

F. Development of Drainage Infrastructure

The current state of the drainage system was thoroughly examined, with photographs taken to document the condition of each individual drain. Informal interviews were also conducted with local residents, particularly in the Migira area, to gain insight into public perceptions. The study aimed to assess the drainage system's condition through photographic documentation and direct field observations by the research team, in order to evaluate the performance and capacity of the drainage network.

With referring crew field observation and survey data it was claimed that the existing condition of the drainage network system performance and capacity is poor and unable to perform their intended purpose, and most the interviewed peoples around the Migira said that the drainage infrastructures of the city are directed from the center of the city to Migira, whereas some of households were responded that the drainage system bock from the stream gorge to drainage canals due to inadequate capacity of downstream gorge to carry the whole discharge

The dimensions of existing drainage facilities, masonry (concrete) open channels vary depending on the need and design of each channel with mostly trapezoidal (some Rectangular exist) shape and concrete pipes vary from 0.60m up to 0.90m in diameter. Except in some areas, most of the topography of Adama City is generally suitable for both natural and artificial drainage facilities and system network. Therefore, drainage system network in the city can be considered inadequate in terms of quality, network and coverage. Drainage system Network in the city as a whole require construction of large number of drainage facility network for both existing and newly planned for construction.

It was observed that the Adama city drainage systems and infrastructures are not maintained and managed properly. This revelation should be a source of worry for the government and the people alike. Therefore, careful design of storm water drainage system network is crucial.

The main challenges of the current drainage system are:

- Inadequate drainage systems and poorly developed networks
- Blocked water channels contribute to environmental degradation and disrupt natural landscapes
- Disposal of solid waste into drainage systems
- Lack of awareness and appreciation for the importance of properly sloped waterways and ditches
- Illegal discharge of untreated sewage into drainage lines
- Construction of private properties on drainage corridors

- Improper placement of drainage lines
- Inappropriate dimensions of drainage systems, resulting in insufficient capacity to handle large volumes of water and increasing the risk of overflow
- Poor allocation of outlets, limiting the system's ability to manage flooding effectively
- Some areas lack drainage infrastructure entirely

C. Attraction of Investors

Investment known by its potential employment opportunity and capital investment both in urban and rural areas. Practices both by government and private sectors although the lion's share takeover by the private sector. The source of investment in the country are from abroad, domestic and joint venture; and they are investing on different sectors like agriculture, manufacturing, service, chemicals and detergents, food and beverages, agro-processing, commerce and trade, financial institutions, textile, etc. However, there are special priorities the government gives attention. According to EIC (2018), textile & apparel, leather & leather products, agro-processing, pharmaceuticals, chemical products, metal & engineering industry, electronics & electrical products, paper & paper products, and construction materials are the priority areas of investment in Ethiopia.

Well-developed infrastructures, favorable market and income tax-exemption are the major factors why investing in Ethiopia as noted in EIC, 2017. Up to 10 years corporate income tax exemption, up to 14 years corporate income tax exemption for pharmaceutical manufacturers and up to 5 years personal income tax exemption for expatriate employees of industrial park enterprises (tenants) following issuance of business license located in industrial parks are the major income tax exemption incentives for those need to invest in Ethiopia, and so does in Adama city. On the other hand, as clearly indicated in EIC Investment Guide (2017) the favorable markets to invest in Ethiopia are:-

➢ Ethiopia is Africa's second most populous nation with a population size close to 100 million.

➢ 54 million active labor force, trainable and available at competitive wage rate in Ethiopia.

➢ Duty-free, quota-free access to the USA and EU markets through AGOA and EBA, respectively

➢ Duty-free, quota-free access to Japan, Canada, China, Turke y, Australia and New Zealand

Covering substantially all export goods from Ethiopia and preferential market access to India.

➢Member of COMESA with preferential market access to a regional market of 400 million people.

➢ Strategic location with proximity to the Middle East, Europe and Asia.

D. Maintaining Urban Form

Roads are commonly considered in modeling and forecasting urban growth; because they are a major

catalyst of sprawl. Important to realize that road infrastructure development are essential factors to cities and its neighborhood development. As the interview made with Adama City administration deputy manager, the addition of road network, maintenance and upgrading of the road condition have attracted investors and the residents to build standardizes houses. Among the total of 71,729 houses 535 (25%) houses were standardized that are substituting the older and also the construction of G+2, similarly 35% (750) housing units were built this was maintained the urban form. But the condition of road infrastructure is still insufficient to attract more investment to build standardized houses to maintain the city form.

E. Socio Economic Impacts

The interview made with the Adama City administration, the upgrading and improvements in road infrastructure condition have played a great role in improving the lifestyle of the residents in the City, previously people in the urban periphery do not have social interaction they were living in isolation. In opposite to this as the Adama City Deputy Manager stated currently in the City urban expansion have changed that in these circumstances; the community who live in the periphery areas previously, now becomes in the center and considered as part and parcel of the urban community and have got the chance to participate in any planning and developmental issue of the City. In addition to this, the improvement in road infrastructure has provided to them, increased their mobility pattern to CBD and got other social services like lightening, potable water and school.

As interview made with one of the Barecha Woreda residents, whom previously reside at the urban fringe, but currently, he is considered as part of the urban. According him currently, he is gaining that he is previously not gained like road, water market, lightening and school. Beside of this he also stated that the improvement in road condition has paved the way to participate in the home based economy, because they have the chance to be located on the route, now I am engaged textile factory.

In addition to this the interview made with one of Migira Woreda residents, she resided in the periphery area, but currently due to urban expansion and improvement in road network she becomes part of urban, previously she was engaged street vendor, but currently she is engaged in the home based economy, she has small shopping and cook bread and distributes to the other. So in a general urban expansion in Adama City have positive impacts that it paved the door for the increments in the road network and improved the existed this in turn changed the socio- economic level of the peripheral community, they were engaged in different home based economic activities.

4.8.2. The Negative Impacts of Urban Expansion on Road Infrastructure Development

The spatial expansion and land use change in the world seem to be catalyzed by the transport infrastructure development and population growth has affected travel over time. According to Batty et al (1999), the impacts of urban expansion on road infrastructure development have been further investigated by relating some urban growth indicators (population growth, urban spatial expansion, residential, institutional and industrial area growth,

A. The impacts of Urban Expansion on Road Investment Cost

According to Gottmann, J. (1961), the construction of additional road infrastructure will take a huge amount of money which is considered as wastage.

a. Cost of Asphalt Road Construction

1km Asphalt road = 230,093,518

2.2 Km Asphalt road =230,093518x2.2 km=**506,205.740** Birr is needed to build asphalt road.

b. The Cost of Cobble Stone Road Construction

1Km cobble stone road = 5,616,773.39

17.2 Km cobble stone road = 5,616,773.39 x17.2Km **= 96,608,502.32** birr

c. The Cost of construction for Gravel Road

1Km gravel road=6,363,021.2 x 52.4KM gravel road = **333,422,310.84** ETH Birr is needed to cover the road network with gravel road infrastructure. From the above discussion the 936,236,553.44 Eth Birr, in the same ways if it needs to provide cobble stone road it will cover 96,608,502.32 Eth Birr and if the municipality wants to provide gravel road it will incur 333,422,310.84ETH Birr. In addition, the new Asphalt road wants to 506,205,740.28 Eth Birr. Finding revealed that urban expansions have created negative externalities on the municipality during the provision of road infrastructure. In general the cost of investment for the construction of asphalt road much greater than that of

Gravel road construction. Therefore, this created a pressure to increase additional cost of investment, to provide additional road infrastructure in the expansion areas.

B. The Impacts of Urban Expansion on Compensation Cost

The interview made with the Lugo sub-city administration Manager, they are paying a compensation for the acquisition of land in during widening and paving of road infrastructure in a cash form, as he state they have no complaints with the community due to compensation case. Beside to this information gathered from the settlers, it costs them about 12-25 thousand Birr to construct one simple two room house. The municipality is demolishing 129 houses in City, the total amount of money wasted by the residents were about 2,386,500 million Birr. But the

information forwarded by the Deputy Managers contradicts with the information obtained from the key informants, as they stated that no, compensation is paid for as either in the form of cash or land we lose our house and also our land, but the municipality are not willing to pay compensation for as. To prove this the researcher has investigated a deep interview with purposefully selected key informant; as the interview was made with one of residents**;** result indicates that I am 63 and it is 40 years since I started living in Adama City, have seven children. The total area of my houses was about 250m^2. However, the coming of the current master plan came with improved road width and paving of road networks has the factors for the demolishing of my houses. Now, I am left without my houses; I got only the remnant of the demolished house, but the house is to be estimated 1,850,000 Ethiopian Birr. No compensation is paid for me, this has affected my livelihood negatively, because previously I received 70,000 ETH Birr by renting for commercial purpose, but currently I have no any source of income for my livelihood.

C. The Socio-Economic Impacts of Urban Expansion

Rodrigue, J-P. (2008), Urban expansion causes displacement, dislocation and segregation that result in social fabrics disorder

i. Accessibility of the Residents from House to different Places

The interview made with one of who is the resident of Adama City, he has two children, he teaches his children's in privately owned school, of Adama Rift Valley, as he stated that he is paying 550 Birr per month in this school, but the cost of payment in another school (St Marry School) is 250 Birr per month, but it is too distant for the children 1.5 km from their home to the school, due to this fact he is forced to pay twice that of St. Marry School.

In addition to this the interview made with Adama district Educational office, the distant is highly affecting the quality of education in the city in that the students does not want to go too far distance from their home to the school, due to this fact they attend somewhat in nearby school, these is increasing the student section ratio, for instant the student to school ratio at KG, Elementary (first cycle and secondary) and high school and preparatory school computed as 1:122,1:900, 1:1429 and 1:137 respectively this is highly affecting the quality of education.

In addition to this the interview made with some of patients in Adama health center, they were travelled more than 2.7km from their home to the health center, to get services, but it is too distant for them, there is no taxi and Bajaj except in the asphalt road, they have faced challenges in getting the service as soon as possible, especially during pregnant period.

According WHO (2008), to the standards seated for health post services should be less than

1km, and less than 2km to go to the health center. But 32.2% and 25.6% of the respondents are travelling a distance of greater than 2.7 km and between 1.6km to 2.6 km respectively, only a small proportion (20.6%) of the respondents are travelling a distance between 0.5km to 1.5 km from their home to health service and this below the standards. There is no enough vehicle transport service within Adama City, Lugo Sub-City people in the sub-city also walk on foot and used only bajaj transportation modality from their home to different activity areas and back again. Here the Researcher has identified three major problems; these are, there is no taxi service in the city; collector and local roads are not convenient for mobility, high dusts rise from collectors and local roads and affect the people of the city.

D. The Impacts of Urban Expansion on Topography

The steeper the slope the more difficulty access becomes, even without road. A steeper slope becomes increasingly difficult to subdivide in an effective manner. There are two factors that are considered in slope during the construction of road infrastructure; firstly, provision of access and provision of suitable site on which the proposed development can take place (Okoko, 2006). Lugo sub-city is facing several problems in road infrastructure development, such as rigged topography and marshes, lack of skilled labor, inadequate maintenance, awareness about sustainability and institutional challenges are the major ones. According to the Managers of Lugo sub-city Administration interview; result shows that topography is one of the major challenges that is resulted due to urban expansion, most of the proposed arterial and collector roads are passed through environmentally sensitive area, like buffer zones in addition to this the dominance of the wetland and rigid topography consume more resource, the construction department also replied that they were proposed to cover 2km area with 60 tone, but the area have consumed 140ton, which is twice to the proposed one in such away, topography is one of the dominant factors in the Lugo sub-city.

4.9. Major Findings

- Lugo sub-city has experienced rapid population growth, urban expansion, land use change and road infrastructure change for two decades that is from 2008 to 2018.
- The existence of the poor road infrastructure provision and management.
- The majority percentages (60.0.1%) is covered with Gravel.
- The existing conditions of road infrastructures are poor in terms of street are earthly surface, lack of pedestrians, poor accessibility and the street light distributed only in a limited area.
- The study founded that the impacts of urban expansion has positive and negative impacts.

- Currently, the development and improvement in road condition have brought for the developments of sister infrastructures.
- Have initiated the active involvements of investors in the Sub-City in different sectors.
- There is no strong sector integration, especially in Municipality office, EEU, water supply, telecommunications, etc.
- In the structure plan, there is no full document that is useful in the planning process like drainage plans, utility plans, expansion area plans, in soft and hard copies.
- The organizational structure is insufficient to implement the plan.
- The specific topography of the sub-city has influenced the road infrastructure.
- The lack of compensation and insufficient compensation for people who are affected by the expansion of the road.

CHAPTER FIVE
5.1 CONCLUSION AND RECOMMENDATION
5.1.1. Introduction

This chapter presents a summary of the key findings from the analysis and concludes the overall results of the study. The findings are organized according to the study's specific objectives, with each objective addressed in a dedicated concluding paragraph. Additionally, this section offers proposed solutions to the main issues explored in the research.

5.2. CONCLUSSION
5.2.1 Land Use Change and the Existing Road Infrastructure in Lugo Sub-City

According to Burns (2007), land use change significantly influences the dynamic transformation of road infrastructure. Similarly, Wenger (1999, p. 265) highlighted that land use primarily affects urban development by generating and attracting movement, while also shaping the transportation network a relatively stable component within the broader context of urban land use change. Findings indicate that Lugo sub-city experienced rapid population growth, urban sprawl, land use transformation, and road infrastructure development between 2008 and 2018. This horizontal expansion was driven by factors such as economic growth in both urban and rural areas, rising housing demand, and the expansion of social services. Consequently, the city

added 49.48 km of new road infrastructure. However, this rapid urban growth, closely linked to frequent land use changes, has resulted in inadequate road infrastructure and poor management.

5.2.2. The Present Conditions of Road Infrastructure

The study found that in Adama City Administration Lugo Sub-city, around 60.01% of the road network is surfaced with gravel and cobblestone, totaling 131.67 kilometers. In addition, earthen roads and red ash roads cover 79.25 kilometers and 102.05 kilometers, respectively, accounting for 14.6% of the network. The road infrastructure inventory also recorded 2 roundabouts, 20 bridges, and 269 culverts across the city. Furthermore, road medians span a total length of 5,164.15 meters. Despite these figures, the overall condition of the road infrastructure is poor, marked by unpaved surfaces, a lack of pedestrian walkways, limited accessibility, and insufficient street lighting, which is confined to only a few areas.

5.2.3 The Impacts of Urban Expansion

5.2.3.1 Positive impacts of Urban Expansion

A. Road Transport Infrastructure Expansion

The study found that urban expansion has brought road infrastructure expansion this is the results of an agglomeration of different factors, these are the demand for mobility, utility infrastructure and also the expansion of social services in the City.

B. The Regeneration of Sister Infrastructures

The study's findings indicate that urban expansion in Adama City has played a significant role in the development of complementary (sister) infrastructure. While the city previously lagged in such infrastructure development, recent improvements in road conditions have stimulated the growth and expansion of related infrastructure systems.

a. Electric Power Distribution of Adama City

The study found that the distribution of electricity in Adama City is increased from 42% to 69%; this is resulted due to the developments in road infrastructure in the City.

b. Developments of Telephone service

The study found that the provision of road infrastructure has improved their communication level; previously they were used Tele center as the only communication service center, but currently the improvement in road infrastructure development paved the way for the distribution of telecom service in their vicinity, rather than taking until center as the only means of communication.

c. Improved water supply

The study found that the development of road infrastructure has brought an increased in urban water supply, from two 2.7 km to 7.3 km of pipeline at household level in the expansion area of the Lugo sub-city.

C. Attraction of Investors

As the findings of the study revealed that the previously the participation of investors were very low, but currently the addition of 26km of Cobblestone road and in 2020-2025 the maintained 14km of gravel road networks around the Migra, Municipal office and "Harar Kella", Asalla mewcha Road, these have initiated the active involvements of investors in the city in different sectors. This has created a job for job seeker in the city, according to their professions.

D. Maintaining Urban Form

The study found that the development and improvements, road condition in Adama City are attributed in modeling and ensuring its shopping.

E. Socio Economic Impacts

As the study revealed that, the upgrading and improvements in road infrastructure condition have improved the lifestyle of the residents in the city, previously people in the urban periphery do not have social interaction they were living in isolation, currently became part and parcel of the urban, in that they engaged at home based economy.

5.2.3.2 The Negative impacts of urban expansion on road Infrastructure

A. The impacts of urban expansion on Investment cost

The study found out that urban expansion has impacts on investment cost of road infrastructure development, the cost that required for the construction of asphalt (corridor), cobblestone and gravel road surface types **50,506,205.740**, **96,608,502.32** ETH Birr and **3,422,310.84**ETH Birr, respectively within the year 2024/2025.

B. The Impacts of Urban Expansion on Compensation Cost

Due to the narrowness of the road width, congestion, lack of pedestrian walk and lack of drainage infrastructure, the revised master plan come up with a new trend. The change in road width from 14 meters to 20 meters that resulted in demolition of a number of houses which requires a huge amounts of investment costs beyond the capacity of the municipality to acquire land for broadening and paving of road services in the City.

C. The Impacts of Urban Expansion on Socio-economic

The study has found that people were traveling the distance between 0.5km to 1 km, 1.1km to 1.5km, between 1.6km to 2.6 km, and more than 2.7 km to and from different activity areas

within the city. Here the finding has identified three major problems; these are, there are no sufficient taxi services in the City, Collector and local roads are not convenient to vehicles and even people walking on foot and only by Bajaj transportation modality system.

D. The Impacts of Urban Expansion on Topography

The research found out that the expansion area highly delineated with different topographic characteristics like gorges, swampy areas, query sites and rugged topography, that were not suitable for the developments of road infrastructure, in addition to that, collector and arterial roads are proposed in environmentally sensitive areas, which need a huge investment cost and environmental degradation. According to slope analysis the area is reside between 11%-15% that implies there is a requirement of a huge investment cost for the realization of road and drainage infrastructure networks.

5.2.3.3 Lesson Learnt

The best experiences that the researcher derived from Canada that were experienced rapid urban expansion and poor road infrastructure planning and provision, but, through a life span, they have identified capital infrastructure plan as a means of mitigating road infrastructure problem, in order to do this first they were surveyed identified surveyed indicated that a lack of cohesion in departmental decision making (and potentially efficient and effective spending) was a result of insufficient links between departmental and strategic or corporate planning activities. In order to achieve this objectives and to ensure the sustainable provision of road infrastructure in the long term they have focused on seven areas:

1. Strategic planning
2. Information Management
3. Building public support and Acceptance
4. Exploring new and innovative methods for continuous improvements
5. Prioritization Model: Weighting and Ranking systems
6. Prioritization model: Linking capitals with operation and monitoring budget in planning.
7. Prioritization Model: Business Case Approach

5.3 RECOMMENDATION

5.3.1. Trends of Urban Expansion

Based on the findings of this study, the following measures are very important to overcome road infrastructure problems of Lugo Sub-City: the research findings show that rapid urban expansion with poor and imbalance in its road infrastructure. Therefore, to overcome the problems the researcher has recommended that:

- Assigning the majority of road infrastructure responsibilities to public-private partnerships, local communities, and natives of the city living elsewhere, as they are key stakeholders and active contributors to the city's development.

- Establishing robust institutional frameworks and planning mechanisms that integrate both vertical and horizontal stakeholders, enabling their active participation in the development and coordination of road infrastructure.

5.3.2. The Existing Road Condition

As highlighted in the findings, the road conditions in the city's peripheral areas are unpaved and substandard, while the main asphalt road is notably narrow. Therefore, the Transport Authority, local governments, public-private partnerships, and the community should prioritize improving the quality of road infrastructure and associated elements to enhance the mobility of people, goods, and services thereby supporting the city's overall development.

5.3.3. The Impacts of Urban Expansion

- The findings indicate that the development of additional road networks requires substantial investment. Furthermore, costs associated with compensation are necessary, and respondents reported having to walk long distances due to the lack of sufficient taxi services. In response, the researcher suggests the following:

- The city and its surrounding areas have an abundant local supply of road construction materials such as basalt, gravel, sand, stone, and clay, which can be utilized as inputs for road infrastructure development.
- Urban planners, engineers, and urban managers should work collaboratively with communities, community-based organizations (CBOs), and key stakeholders to provide compensation to affected groups, either in the form of cash or land.
- Relevant authorities should encourage investment in urban roads based on the location of investors' projects. Where feasible, selected roads should be asphalted or properly leveled to facilitate the initiation and improvement of taxi services.

5.4 Recommendation for Further Study

The researcher also examined the impact of urban expansion on road infrastructure development to address the objectives outlined in Chapter 1, Section 3. The findings indicate that urban expansion in Adama City has had both positive and negative impacts. However, due to

limitations in time and financial resources, the study did not explore in detail the underlying causes and broader consequences of urban expansion. Additionally, the financial sources supporting road infrastructure development in the city were not thoroughly assessed. Future research that investigates these areas in greater depth would contribute significantly to ensuring the sustainability of road infrastructure. Therefore, the researcher recommends that the local government adopt the best practices identified in Chapter 2, Section 2.7.1, particularly regarding the provision, operation, and management of road infrastructure in alignment with urban land use planning principles.

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Appendix

Appendix 1

This questionnaire is designed to help a study on assessment of Adama City Administration. The impacts of urban expansion on road infrastructure development. This information are only used for academic purpose for the fulfillment of Master Degree in Urban planning and Design. Therefore your response is very important for the success of the study because all information that you provide determine the analysis and conclusion of the research. Therefore, I request you to answer all the questions below to the best of your information.

Part One: Background Information about the Respondents

Instruction: In order to answer the following questions, put aright (√) in the boxes that located in front of your choices.

1Name of the

Woreda_____,Kebele_____,Ketena_____

2. Age

1. Less than 18 years ☐ 2.between 18-30 years ☐

3. Between 31-50 years ☐ 4.Greater than 50 years ☐

3. Sex

1. Male ☐ 2.Female ☐

4. **Level of education**

1. Illiterate ☐ 2. Primary school (1_8) ☐

3. Secondary school (9-10)

4. Preparatory (11_12) ☐ 5.Certificate ☐

6.Diploma ☐ 7. Graduate ☐

5. Occupation ☐

1. Business owner ☐
2. Private Employee ☐
3. Government employee ☐
4. Unemployed ☐
5. Student 6.Daily laborer
7. Any Other_____

6. How long do you stay in this City?

1. Less than 5 years ☐ 5-9 years 3.1☐4 years ☐

4.15- 19 years ☐ 5.Greater than 19years ☐

7. Rank the challenges that you face in your mobility environment by putting 1, 2, 3, 4, and 5 according to their severity (1, indicates the highest severity while 5 indicates the lowest severity

	Challenges	**Rank**
1	Inadequate road infrastructure	
2	Problem of good governance	
3	Lack of financial Source	
4	Lack of coordination	
5	Rapid urban expansion	
6	Lack of community awareness	
7	Any other	

8. If your problem is related with road infrastructure, how the extent of severity?

1. Very 2. High☐ 5 very l☐ ☐

3. Medium ☐.Low ☐

9. Do you have a mobility problem?

Yes ☐ No ☐

10. If you're your answer is yes, what is? The distance

i. From your school to your home in(KM)if you are student_____

ii. From your workplace to your home in (KM), if you are employee_____

iii. Main shopping center from your home in (KM)_____

11. Did lack of road infrastructure have an impact on your activity?

Yes ☐ No ☐

12. If your answer is yes what types of impacts have you faced

_____

_____

13 Is their another problems related with the absence of lack of road infrastructure?

Yes ☐ No ☐

-14. If your answer is yes what are the problems resulted due to lack of road infrastructure

_____

_____

15What comment do you have about the state of road infrastructure in Adama City?

---

16. Have you ever been participated in urban road infrastructure development matter?

Yes ☐ No. ☐

17. Do you think that the city road infrastructure carried out through the coordination of local government, private investors and public? Yes ☐ ☐

18. If no, what are the reasons_____

19. Are you satisfied with the City road infrastructure? Yes ☐ No. ☐

20. Which service that is provided by the government needs to be improved more?

1. New road construction ☐ 2.Flood protecting ☐ 3.Maintenance and upgrading ☐

*****THANK YOU*****

Appendix 2

Interview for Selected samples

Interview Questions Prepared for Investigating the Impacts of Urban Expansion on Road Infrastructure Development on urban road users

1. How do you evaluate the condition of the road infrastructure?

	Very Poor(1)	Poor(2)	Fair(3)	Good(4)	Very Good (5)
Road					
Drainage					
Side walk					
Road furniture					

2. How do you rate the service provision of road infrastructure?

Service	Very Poor(1)	Poor (2)	Fair(3)	Good(4)	Very Good(5)
Road					
Drainage					
Side walk					
Road furniture					

3. How do you find the quality of existing road in the City? Please check mark at the right under the proper heading of you agrees.

	Very Poor(1)	Poor(2)	Fair(3)	Good(4)	Excellent(5)
Road					
Drainage					
Side walk					
Road furniture					

4. Rank the following road conditions according to the problem in the City

No	***Problems***	***Rank***
1	Inadequacy of paved and un paved road	

2	The roads Deteriorated	
3	The road lack adequate elements	
4	The roads do not have adequate road reserves	

Appendix III

Interview questions prepared for officials, Road Authority and Experts Municipal

1. Does the municipality have the plan to improve the existing un paved road coverage?————— _____
2. If yes, what length?————————————
3. What length of drainage line exists in the City?_____
4. How is the street light coverage of the City_____
5. Which roads are provided with street light?_____
6. What measures have been taken for the improvements of the condition of street light in the City? _____
7. What are the challenges of road infrastructure provision and upgrading in the City?_____
8. What measures does the municipality take to cope up with the challenges?

_____

9. Is there any business or investments that have been shifted to other Citys due to road infrastructure problems in the City?

1. Yes ☐ 2.No ☐

3. I don't know ☐ 4.No answer ☐

10 Among the following would you be willing to do help reduce the road problems in the Citys?

1. Pay increased taxes for additional roads and to maintain the existing roads ☐
2. Supply material to built new road and maintain the existing roads ☐
3. Contribute money for road improvements ☐
4. Using local resources ☐

11 Do you have standards in service provision a construction of road?

1) Yes ☐ 2) No ☐

12 If your answer is yes at what standards you have provide the service? _____

13 How do you evaluate the relationships between Urban expansion and road development_____

14. From question no 17 how do you evaluate the indicators of urban expansion and road development?_____

15. How do you find the current cost of new and maintenances construction of road

Types of Road	Length in km	For new		For maintenance	
Asphalt		Birr	%of total budget	Birr	%of total budget
Cobblestone					
Gravel					
Earth road					

16. The types of municipal assets

Types of Machinery	Quantity	Conditions
Grader		
Dozers		
Loader		
Compactor		
Surveying instrument		
Others		

18. Number and qualification of personnel in the department responsible for urban road provision and maintenance.

Professional requirement	Available human power in the department	Additional human power required	Gaps
Engineering			
Urban planning			
Surveying			
Drafting			
Construction			
Others			

19. What are the major difficulties frequently seen in the provision of road infrastructure development? Please write down rank according to their degree of impact

No	Major Difficulties	Rank
1	Lack of human and technical factors	
2	Un precedent growth of cities	
3	Community Participation	
4	Capacity problem	
5	Lack of coordination	
6	Financial Problem	
7	Lack of Integration	
8	Urban growth gabs	

18. What are the impacts of urban expansion on urban road development? Please rank in the following table

Types of Impacts	***Rank***
Cost of Investment	
Compensation cost	
Social impact	
In adequate quality and quantity	
Delay /lag development of the City	

19. If your answer will be cost of investment? Please compare the cost of investments with the types of road per km.

Types of road	Km per cost	Area to be covered (in km of road)
Asphalt road		
Concrete road		
Gravel road		
Earth road		
In adequate quality and quantity		

20. Secondly if compensation cost is your second selection, please fill the table below?

Area to be demolish(for the acquisition of land for the road	Cost per area	Total cost required to compensate

ANNEX IV

Asphalt Road Coordinators

1. If your answer will be cost of investment? Please compare the cost of investments with the types of road per kilo meter

Types of road	Km per cost	Area to be covered (in km of road)
Asphalt road		
Concrete road		
Gravel road		
Earth road		

2. Secondly if compensation cost is your second selection, please fill the table below?

Area to be demolish(for the acquisition of land for the road	Cost per area	Total cost required to compensate

3. What are the criteria's that you have apply to classify road ?

4. How do you evaluate the cost of Asphalt road, Cobble, Concrete, Gravel Earth road?

*****THANK YOU*****

ANNEX V

Checklist for review of documents and field observation

1. Road Coverage in the Land use Maps of the City_____

Table 1.The road pavement condition and types

Condition	Asphalt		Gravel		Earthen		Total	
	Km	Percent	Km	Percent	Km	Percent	Km	Percent
Good								
Fair								
Poor								
Total								

3. Road classification

1. Arterial road_____Km
2. Collector road_____Km
3. Local road_____Km
4. Other road_____Km

4. Road furniture

1. Length of asphalt road provided with side walks_____Km
2. Length of roads with street light _____ Km3

Table .2 the existing Drainage Condition of the City.

No	Types of drainage	Length(km)
1	Open earth ditch	
2	Open paved ditch	
3	Open paved ditch	